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United States Patent [19]

DiSieno et al.

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[45] **Date of Patent: Dec. 26, 2000**

[54] **DOCK LEVELER**

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[73] Assignee: **Overhead Door Corporation**, Dallas, Tex.

[21] Appl. No.: **09/078,793**

[22] Filed: **May 14, 1998**

Related U.S. Application Data

[63] Continuation of application No. 08/714,853, Sep. 17, 1996, Pat. No. 5,784,740.

[51] **Int. Cl.**[7] **E01D 1/00**

[52] **U.S. Cl.** **14/71.3**

[58] **Field of Search** 14/71.1, 71.3, 14/71.7

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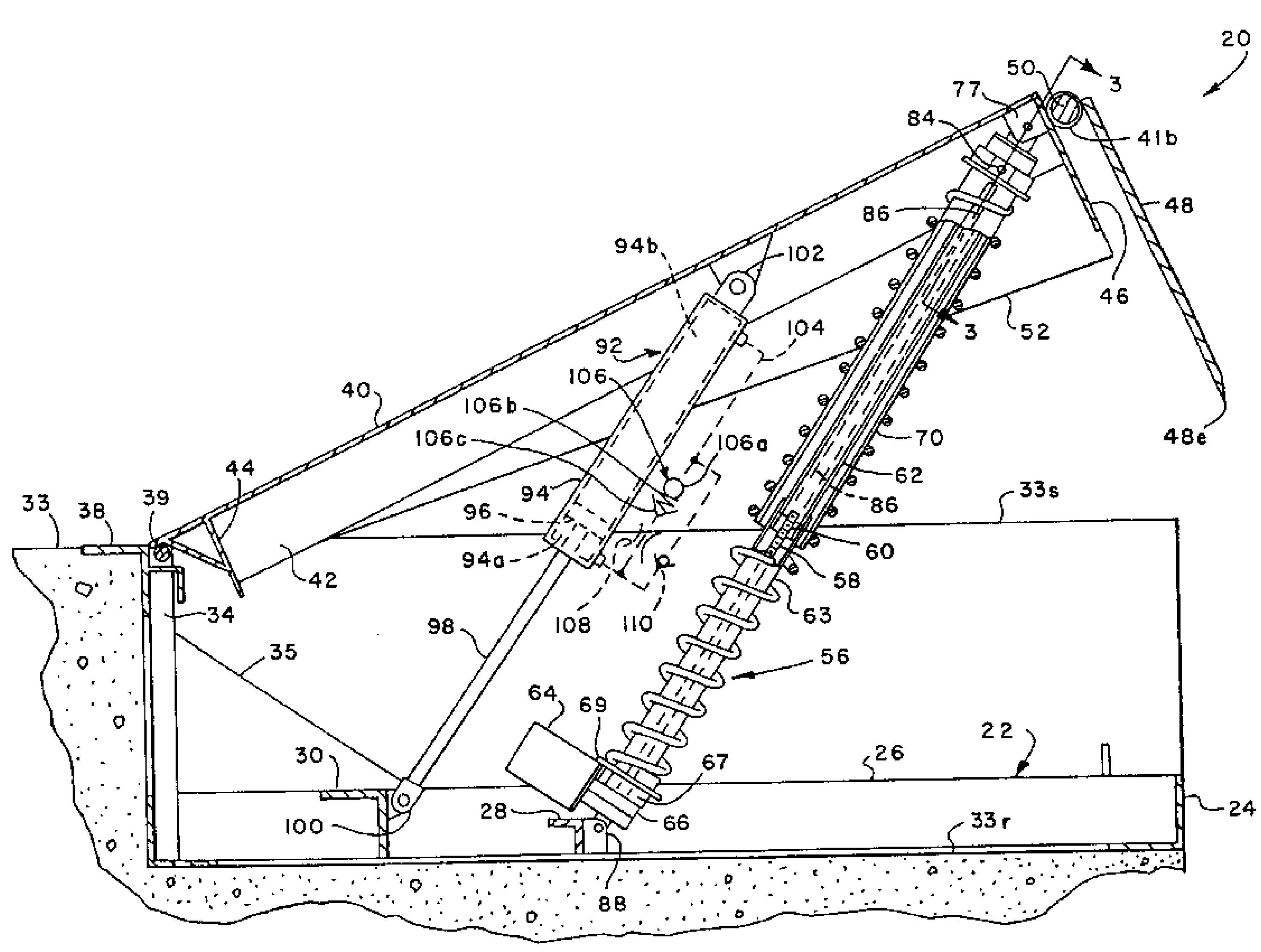
Primary Examiner—Eileen D. Lillis
Assistant Examiner—Gary S. Hartmann
Attorney, Agent, or Firm—Akin, Gump, Strauss, Hauer & Feld, L.L.P.

[57] **ABSTRACT**

A dock leveler includes a pivotally mounted ramp and a lip member pivotally mounted to the distal end of the ramp and moveable between an extended position and a depending position for forming a path between a loading dock and a loadbed of a vehicle. A motor operated linear power screw type actuator is connected to the ramp for moving the ramp to an elevated position and includes an extensible tube member which is engageable with a second tube in telescoped relationship in such a way that the actuator tube may be controlled to be retracted after positioning the ramp to engage the loadbed of a vehicle so that the actuator is not subject to forces exerted by the ramp during oscillatory movement while the vehicle is being loaded or unloaded. In one alternate embodiment the actuator is connected to an intermediate link to allow the pivotal movement of the ramp without exerting damaging forces on the actuator. The lip may be extended by a toggle linkage responsive to movement of the ramp from an elevated position to a declined position in engagement with the loadbed and a latch mechanism is operable to hold the ramp in an extended position until the loadbed is engaged. Ramp support legs are retractable to allow further declining movement of the ramp and are actuatable by a spring connected to a linkage which is moveable to positions to change the direction of spring biasing forces acting to retract and extend the legs.

10 Claims, 17 Drawing Sheets



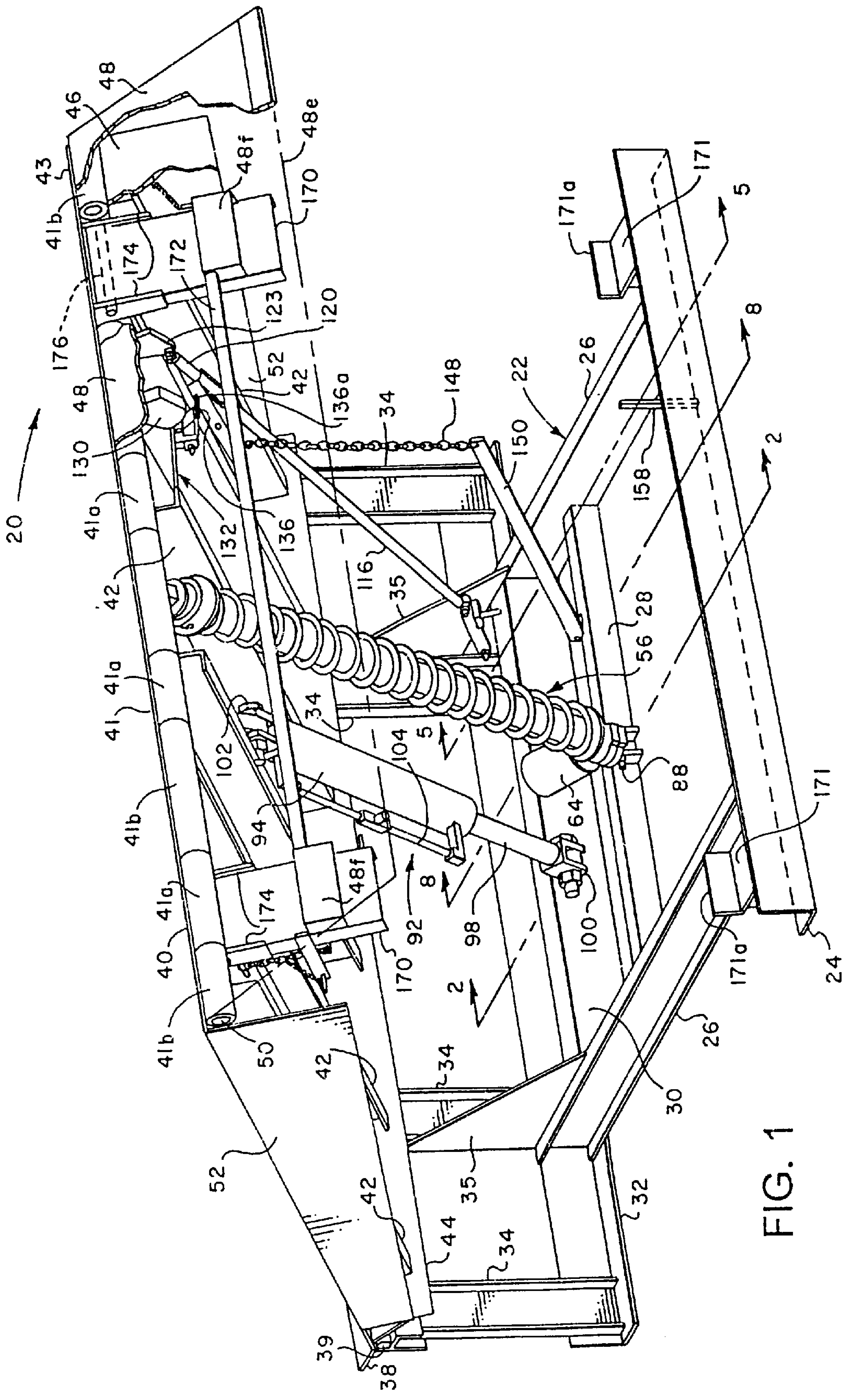


FIG. 1

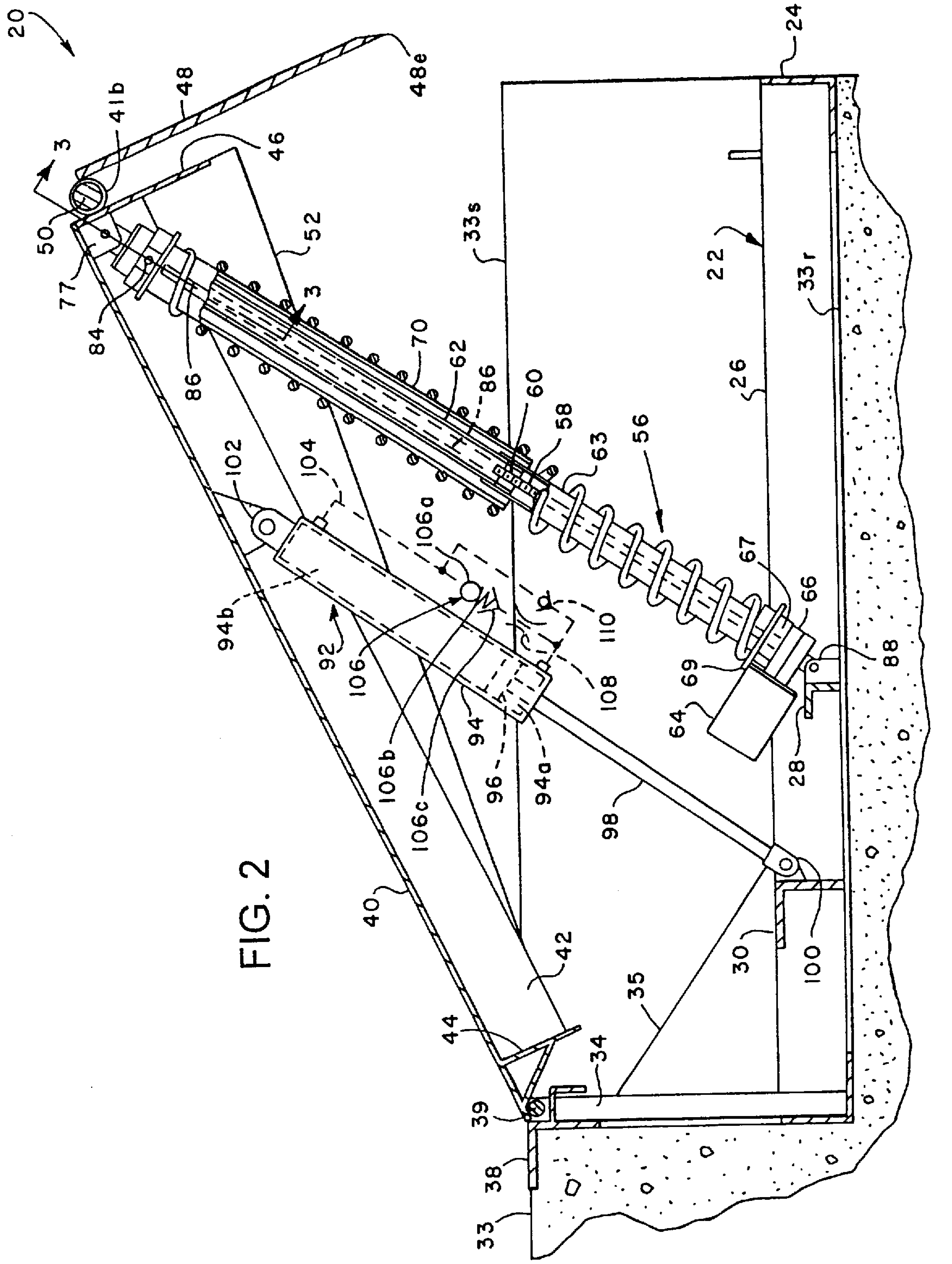

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FIG. 2

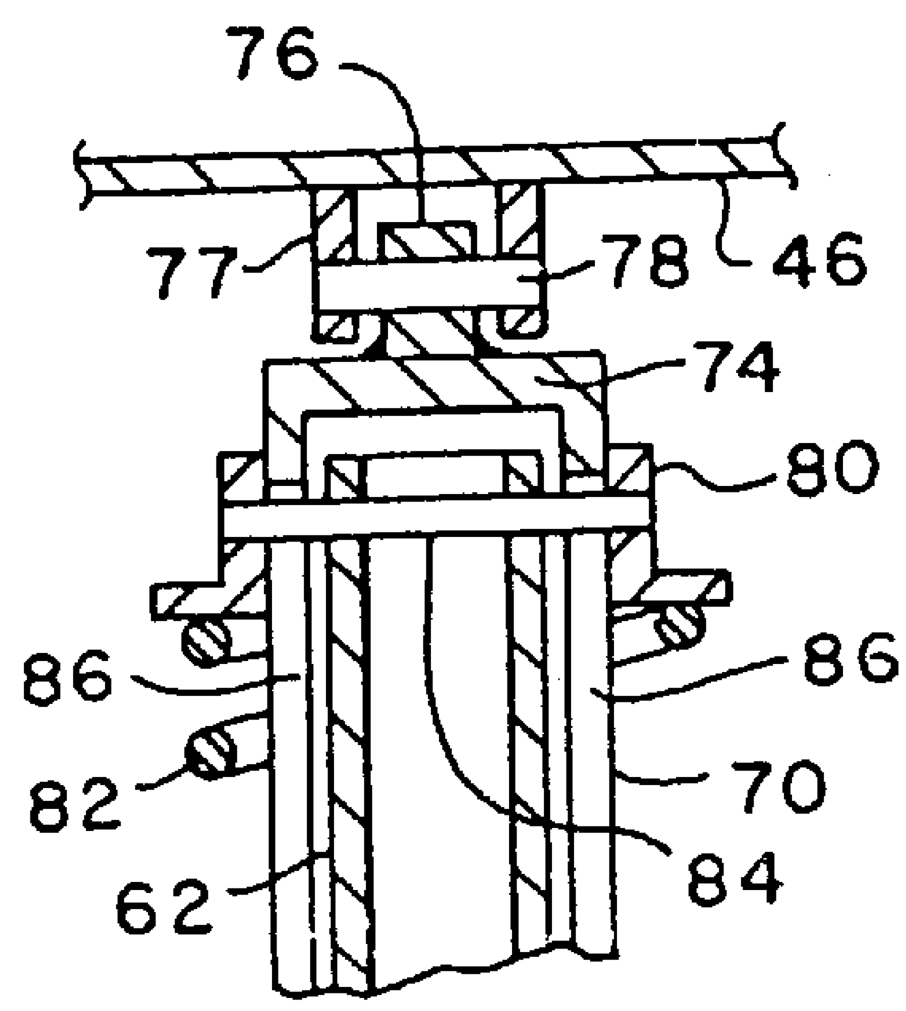

FIG. 3

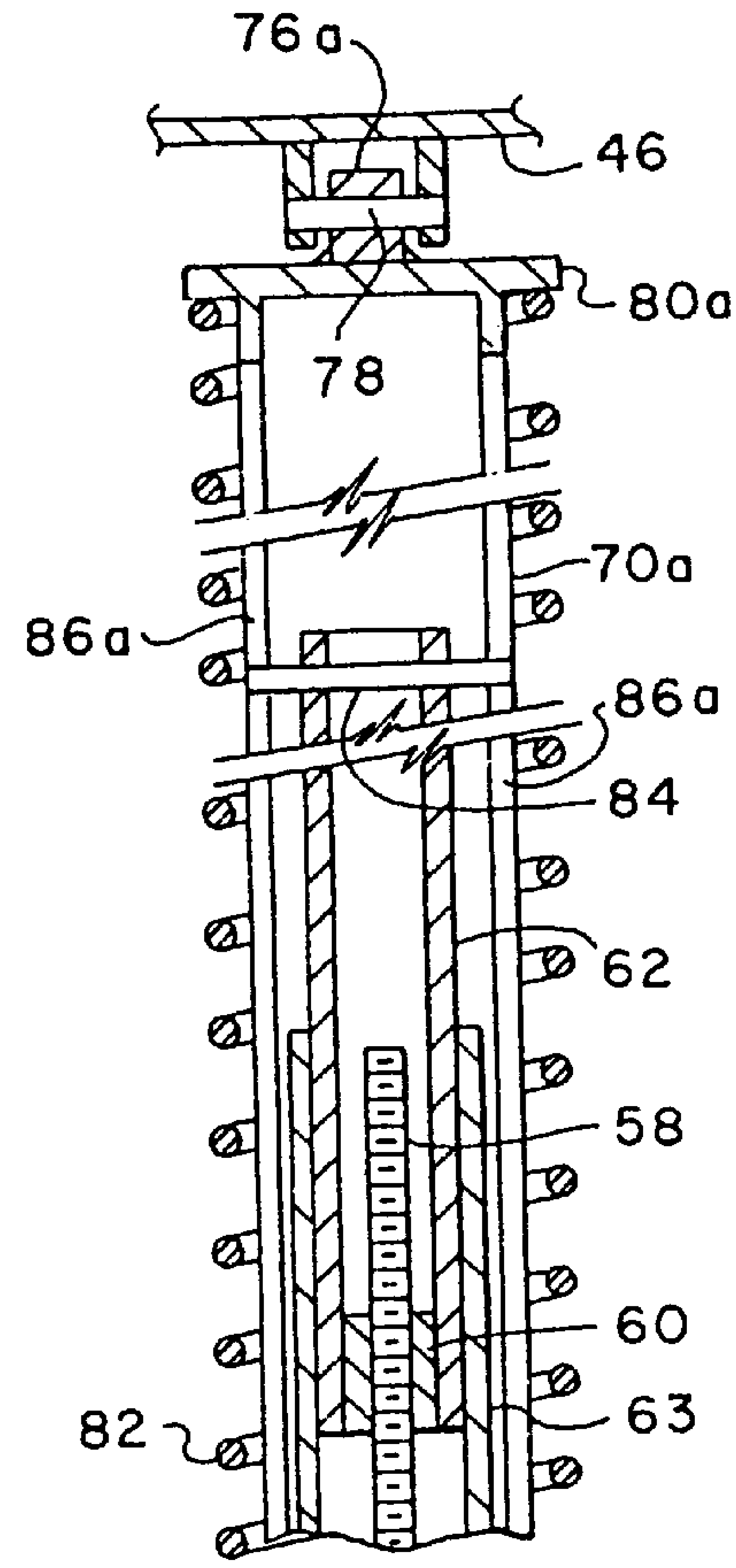

FIG. 4

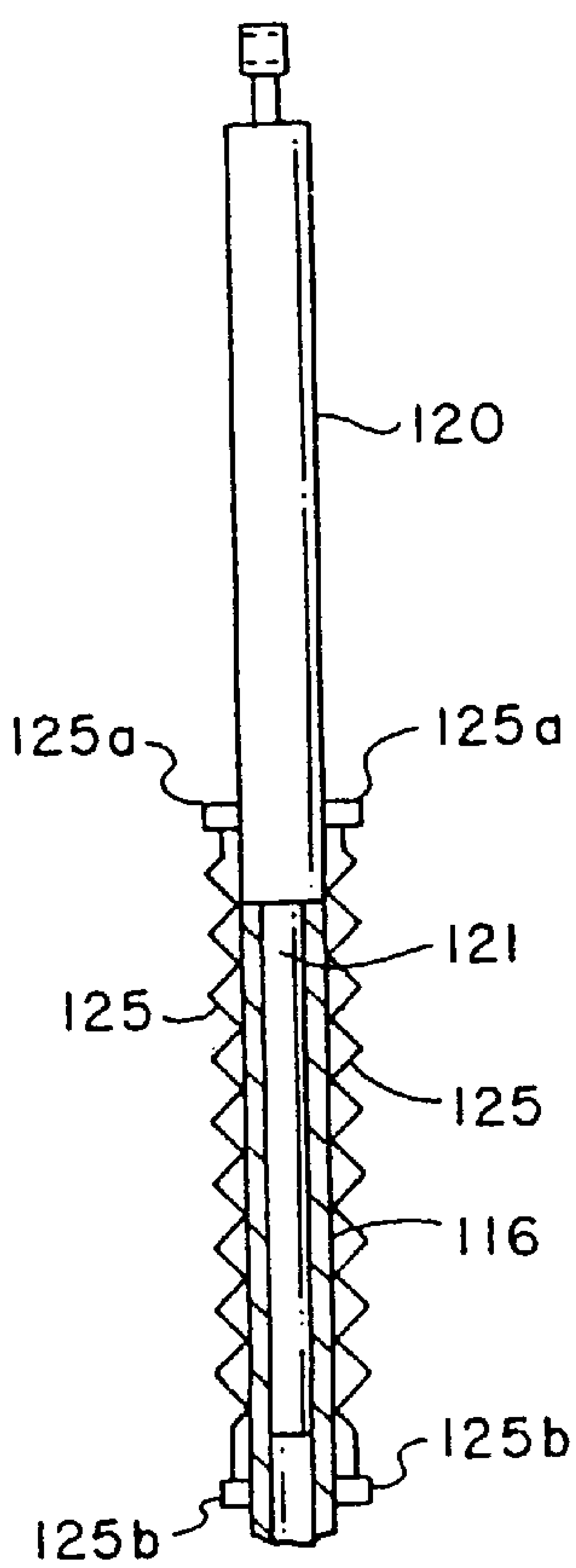

FIG. 6

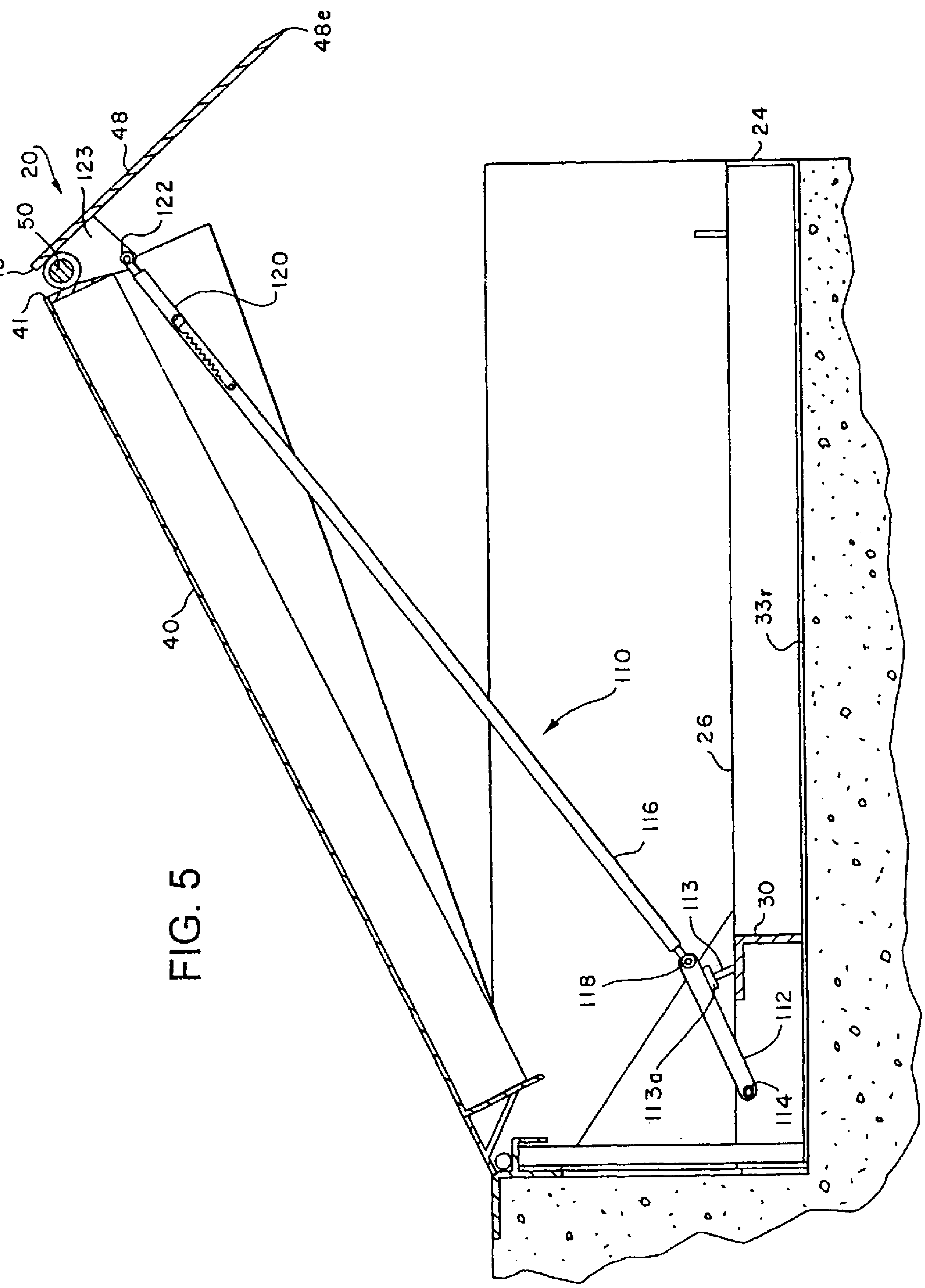
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FIG. 5

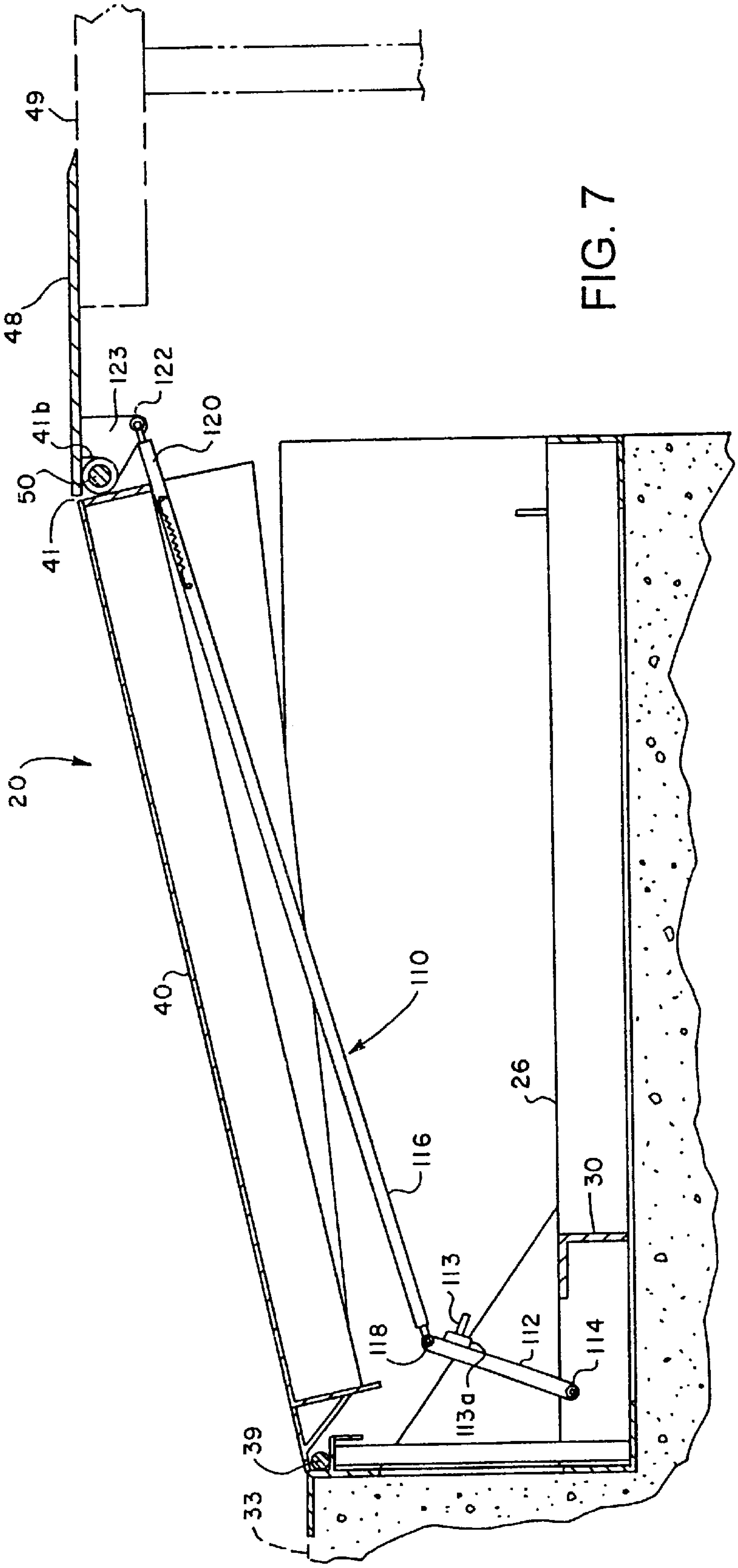
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FIG. 7

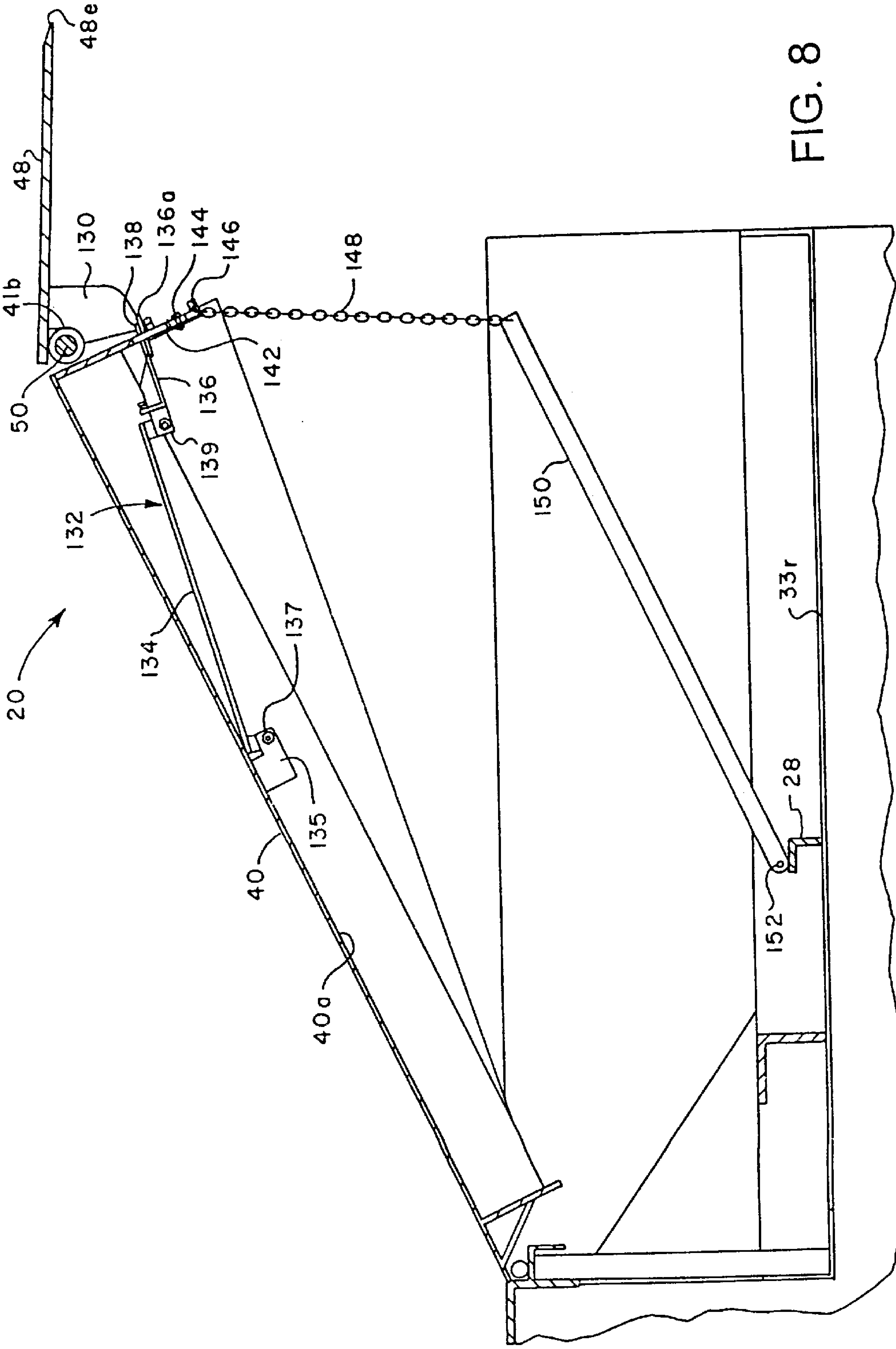
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FIG. 8

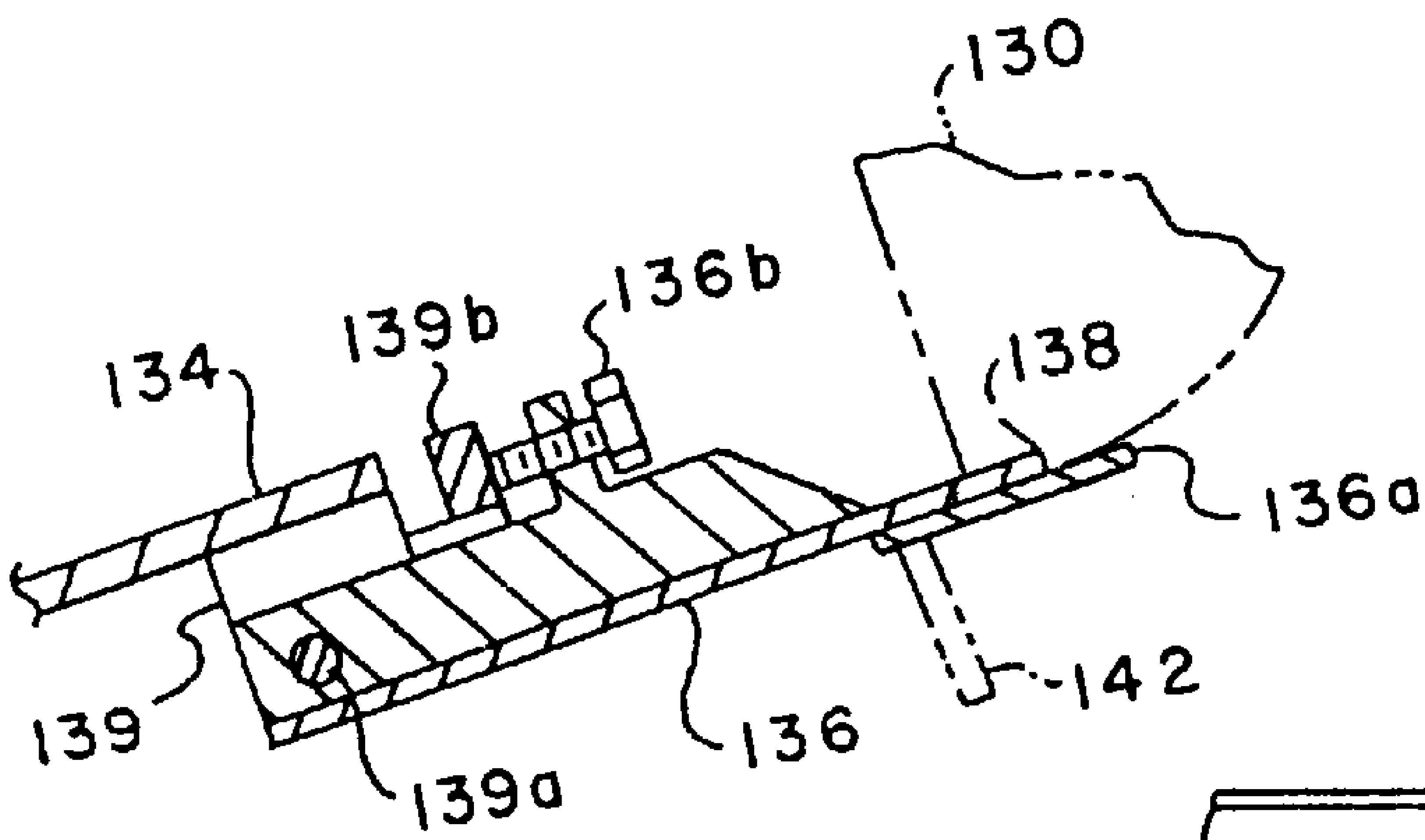

FIG. 8A

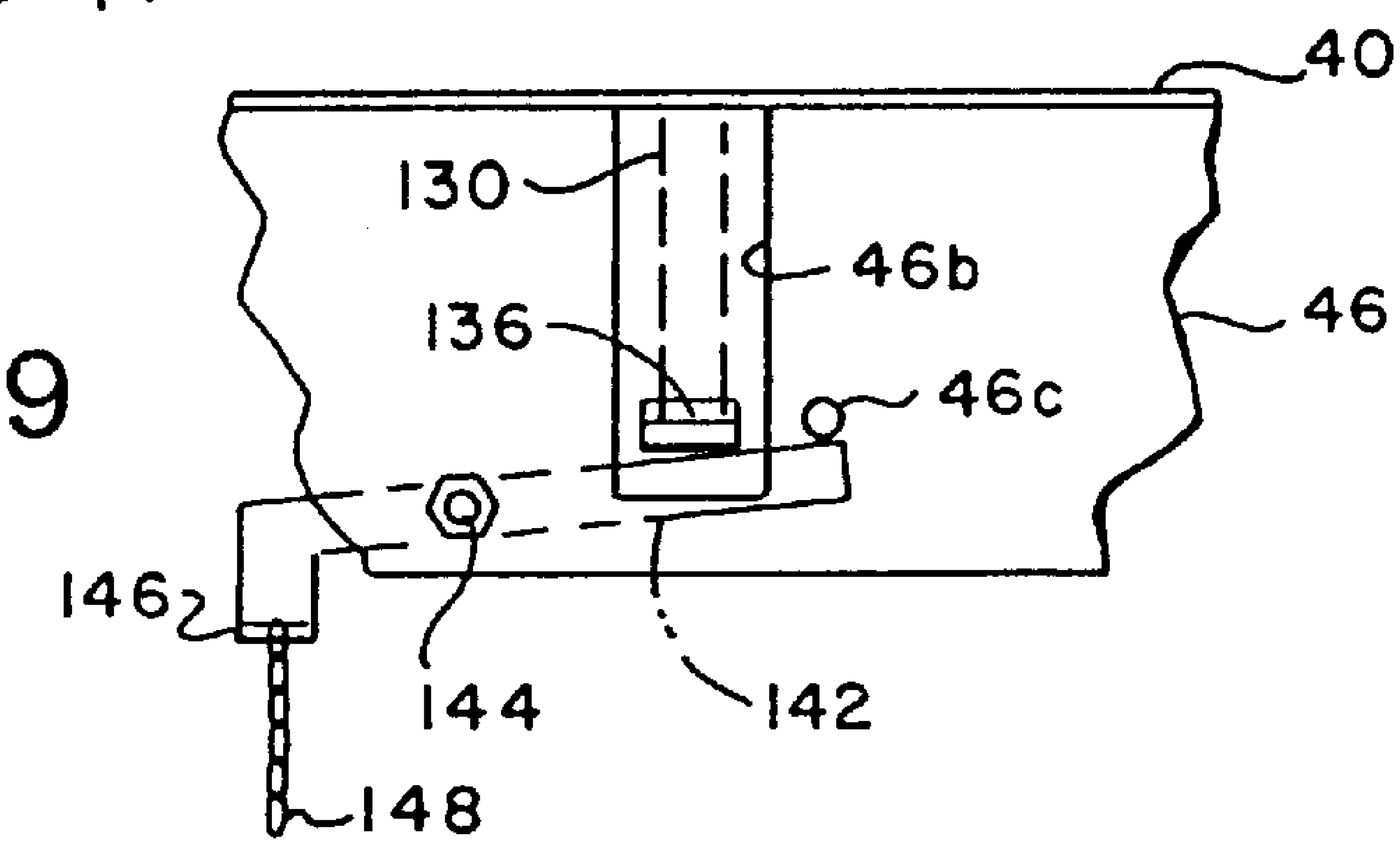

FIG. 9

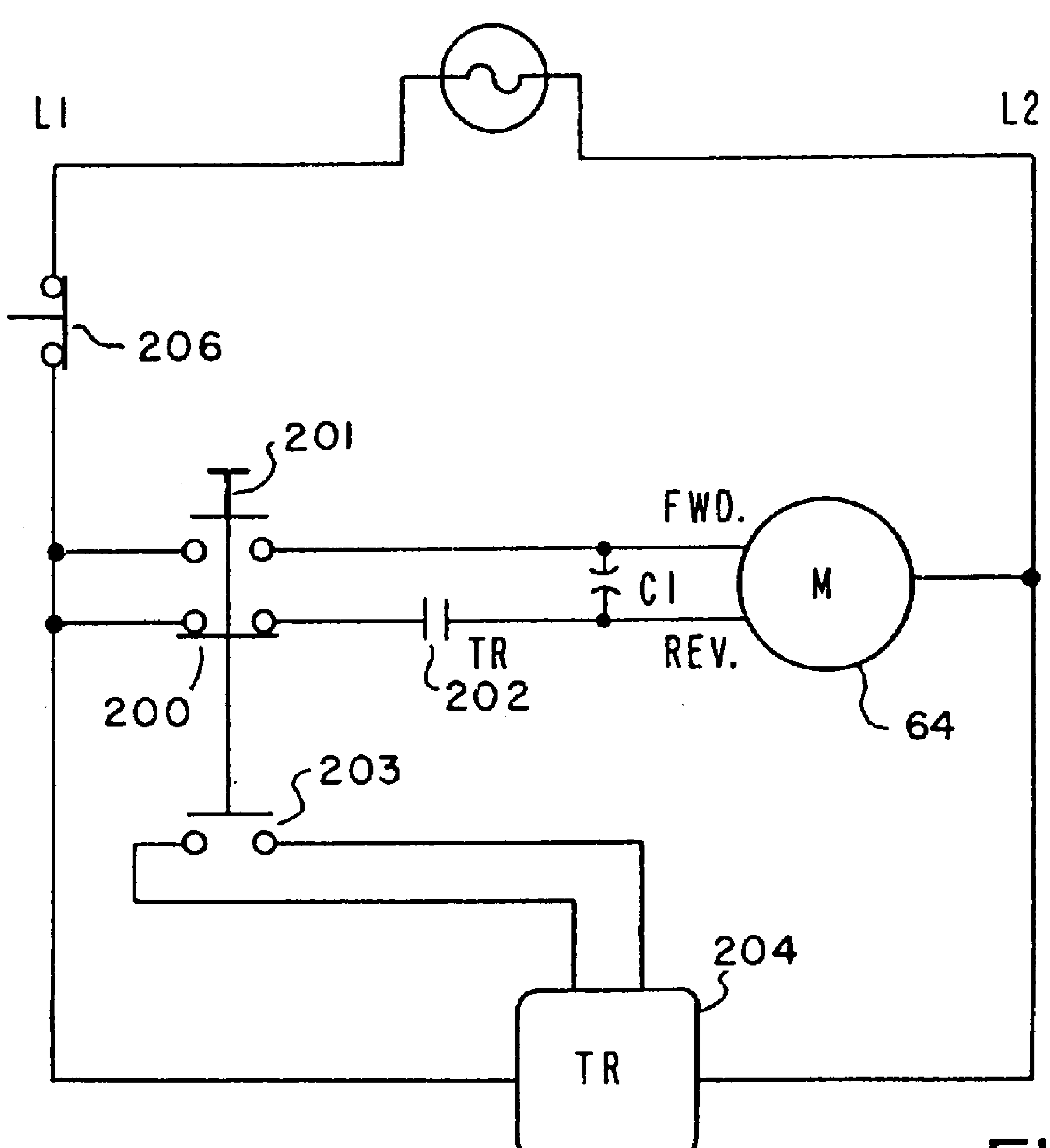

FIG. 12

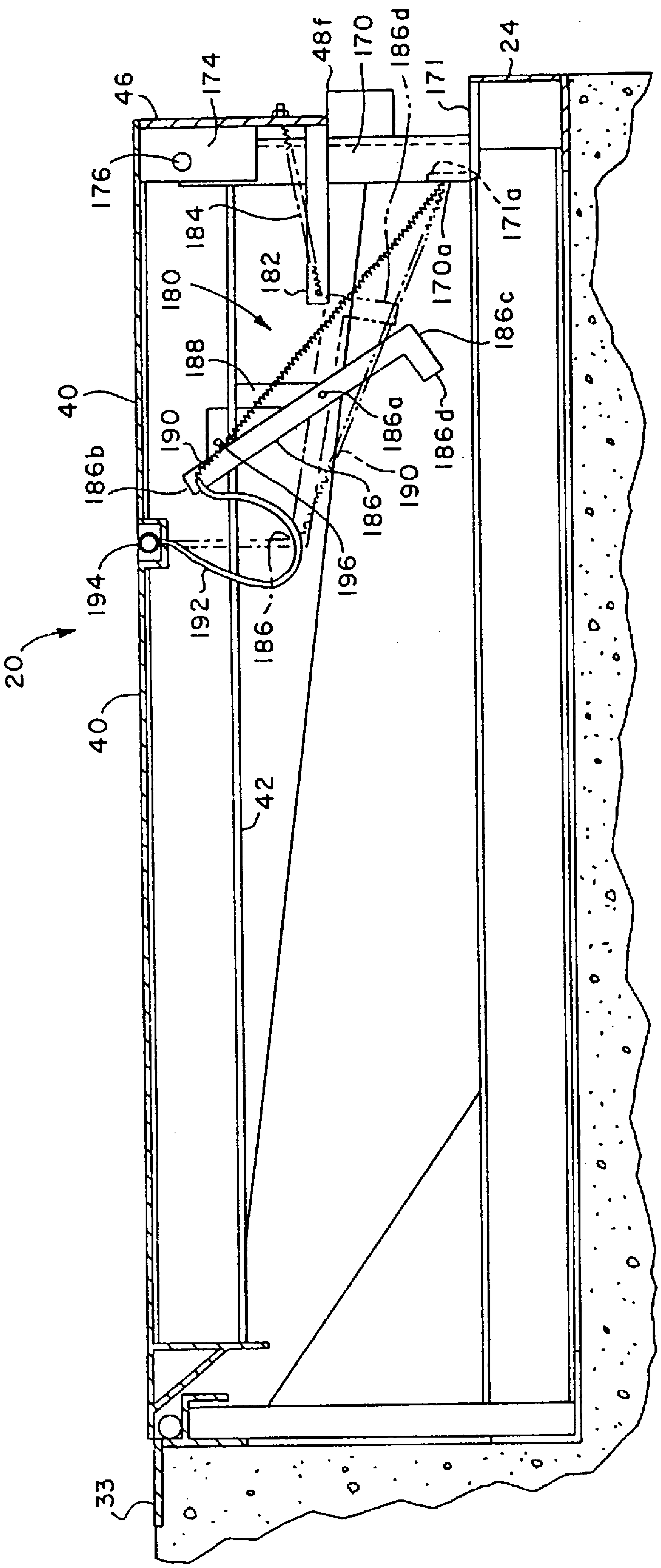

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FIG. 10

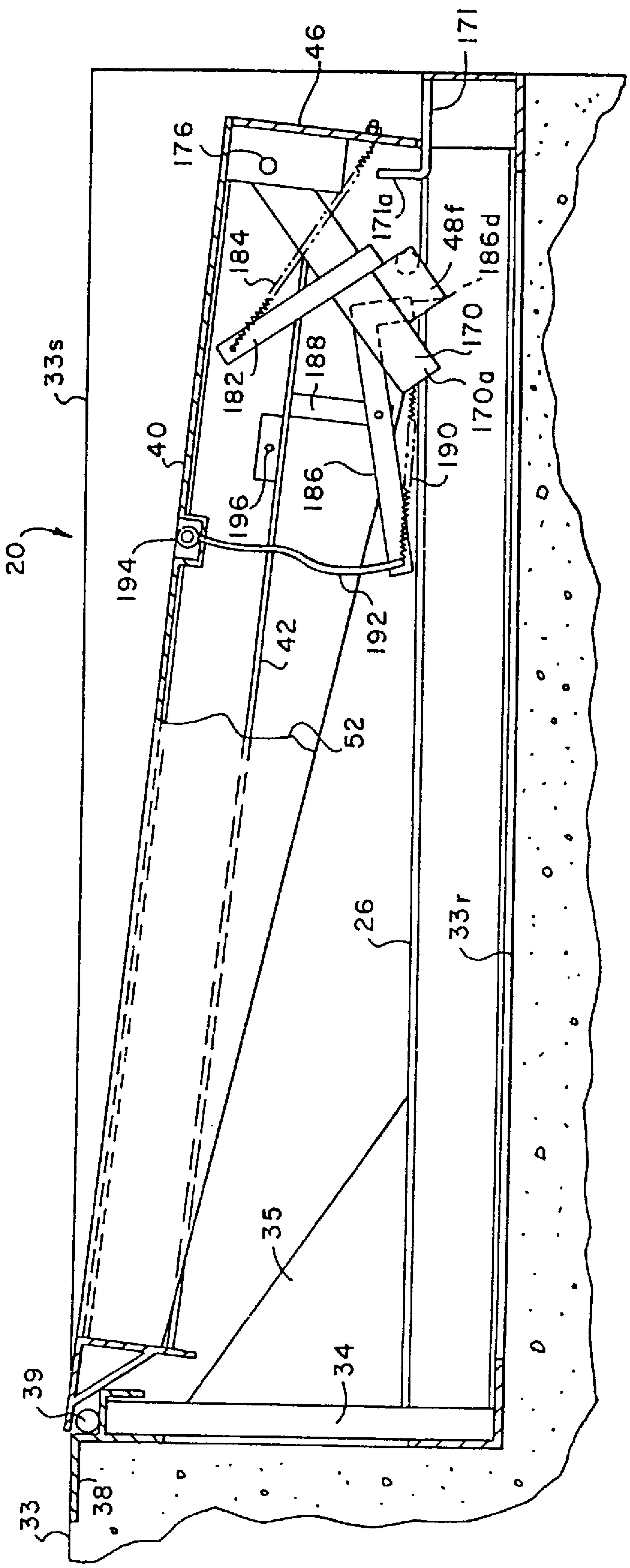
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FIG. 11

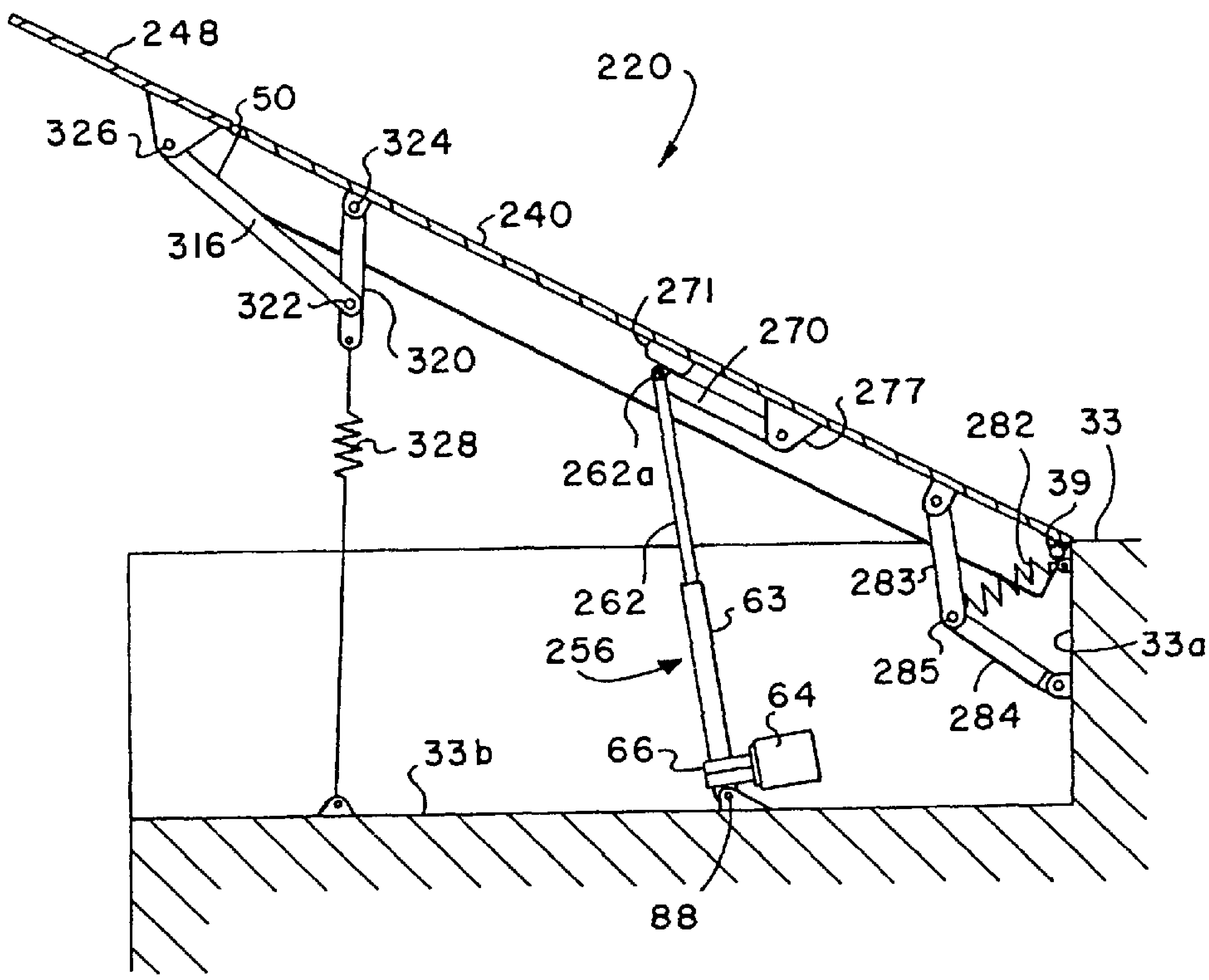
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FIG. 13

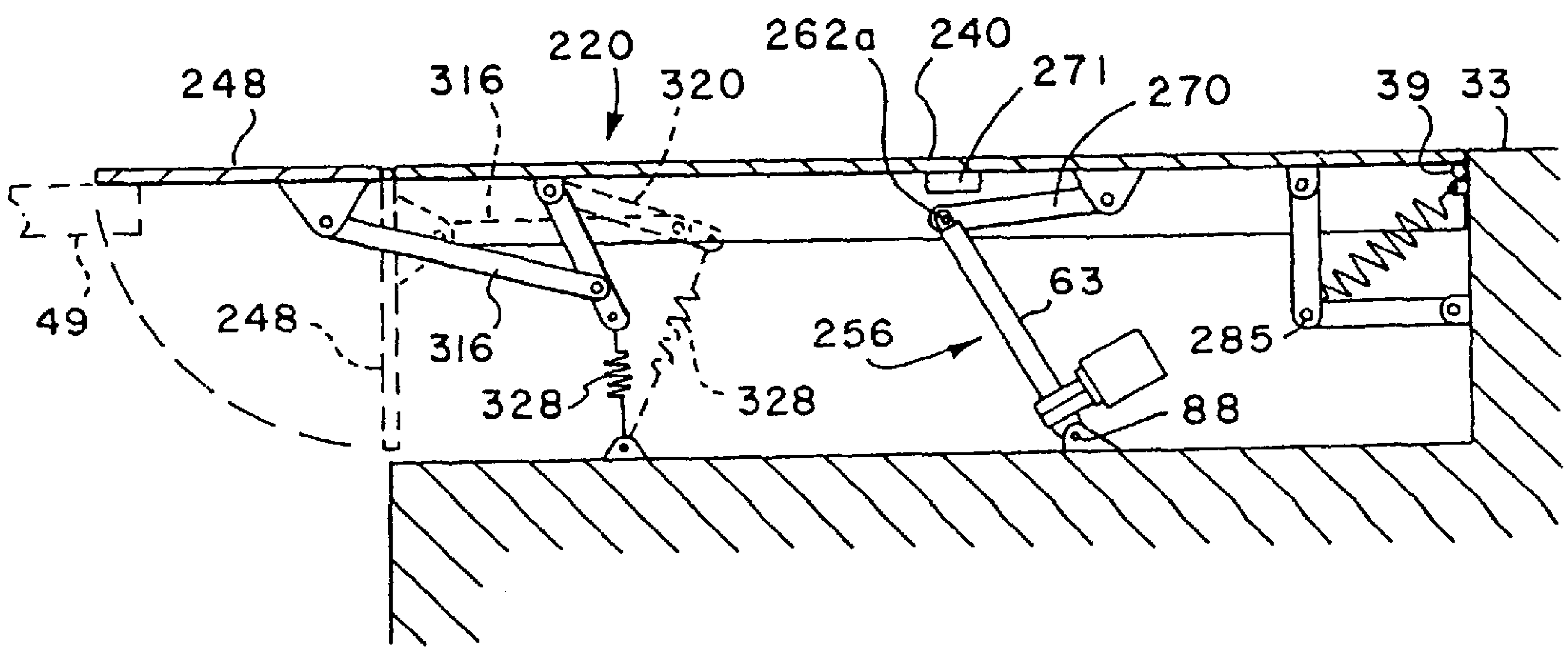
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FIG. 14

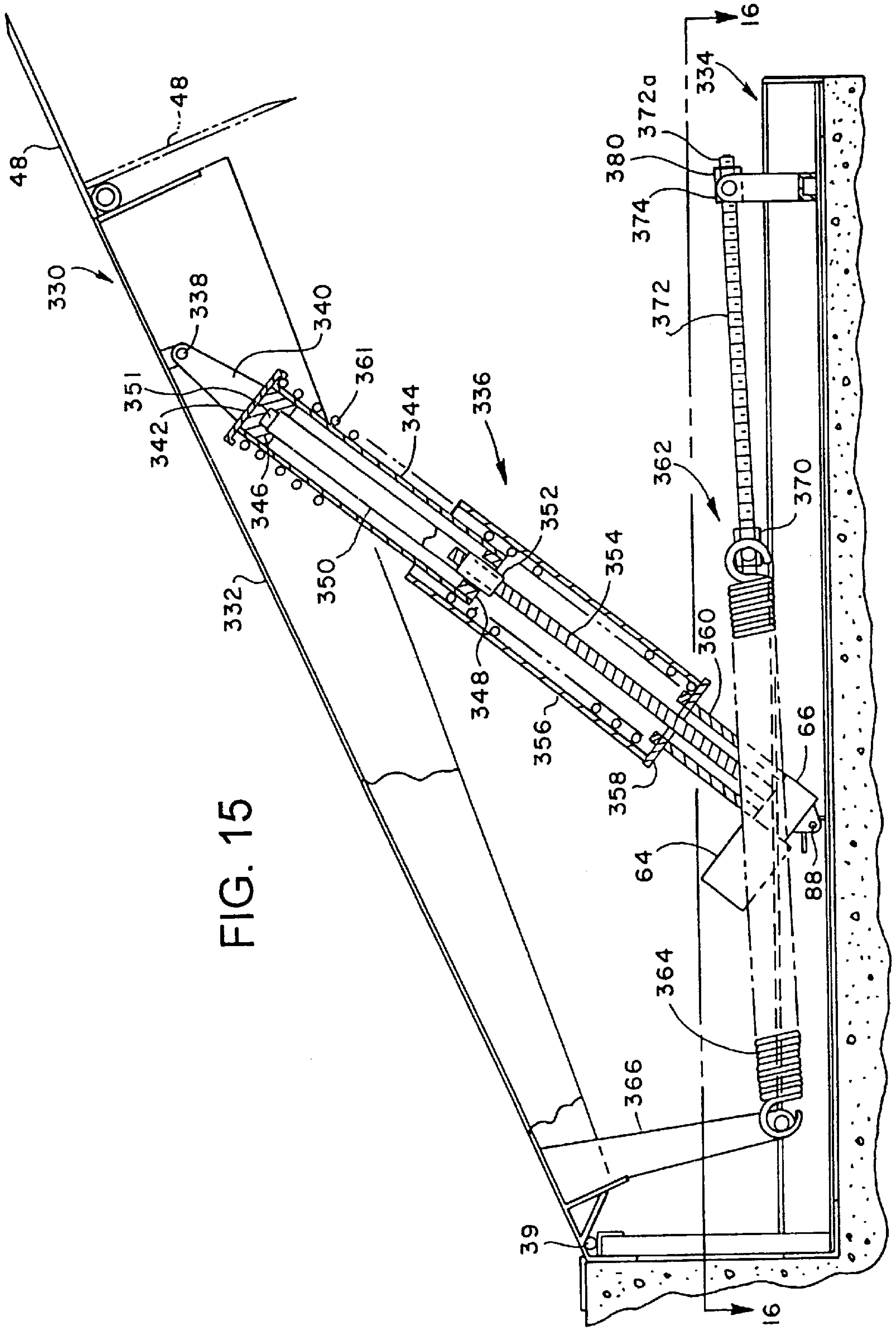
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FIG. 15

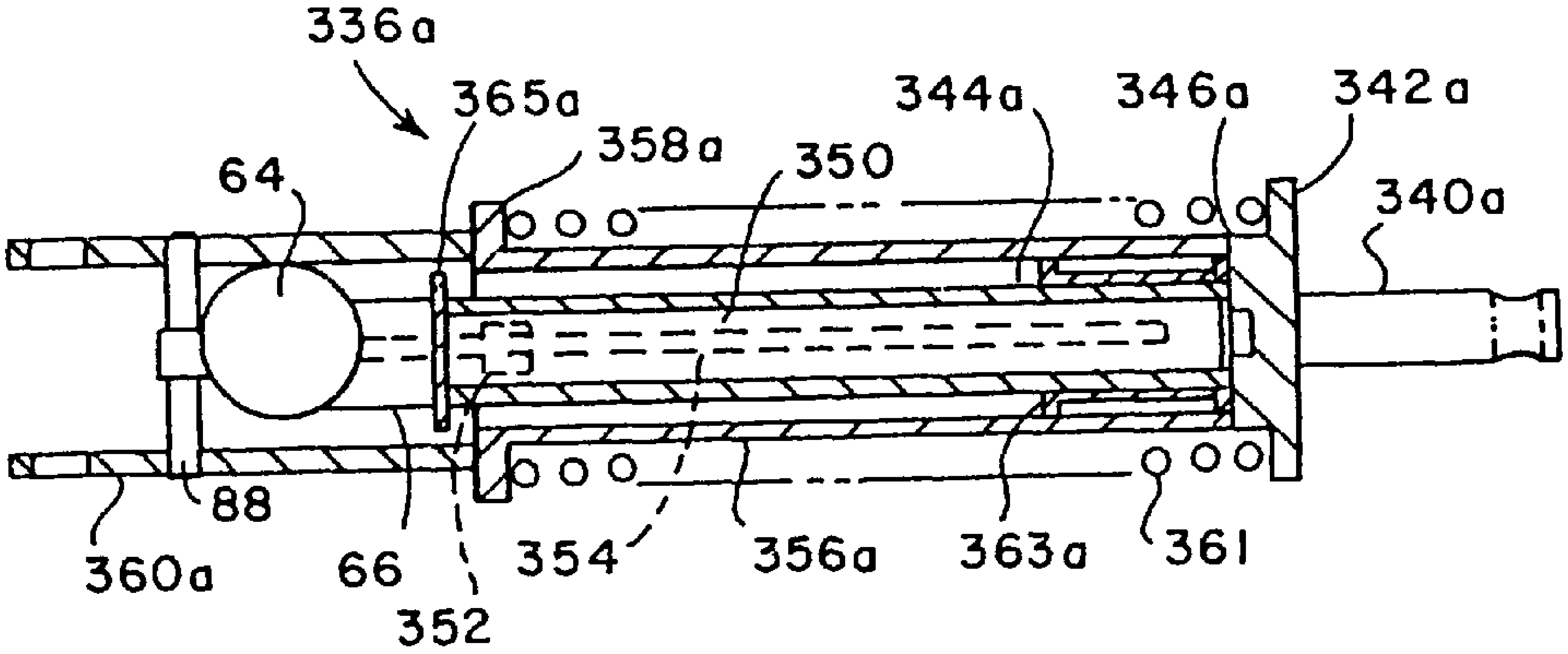

FIG. 15A

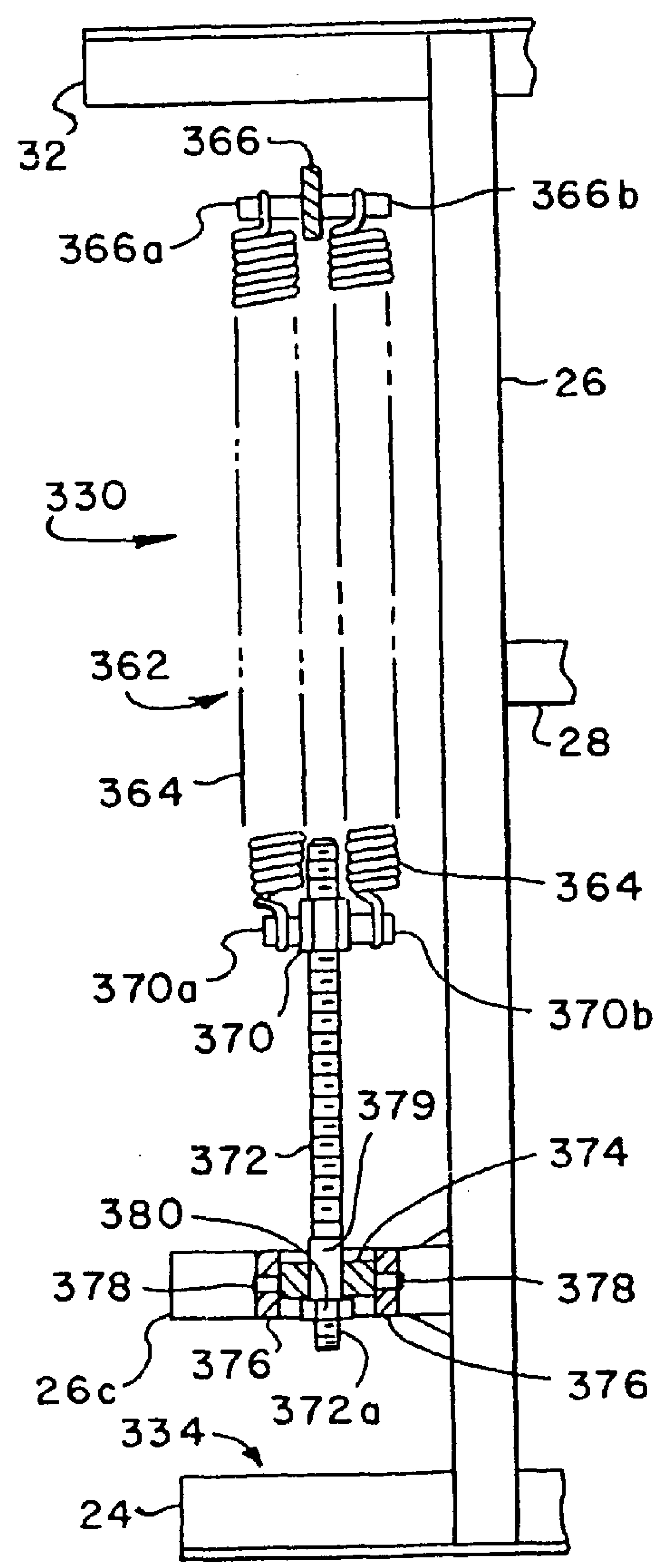

FIG. 16

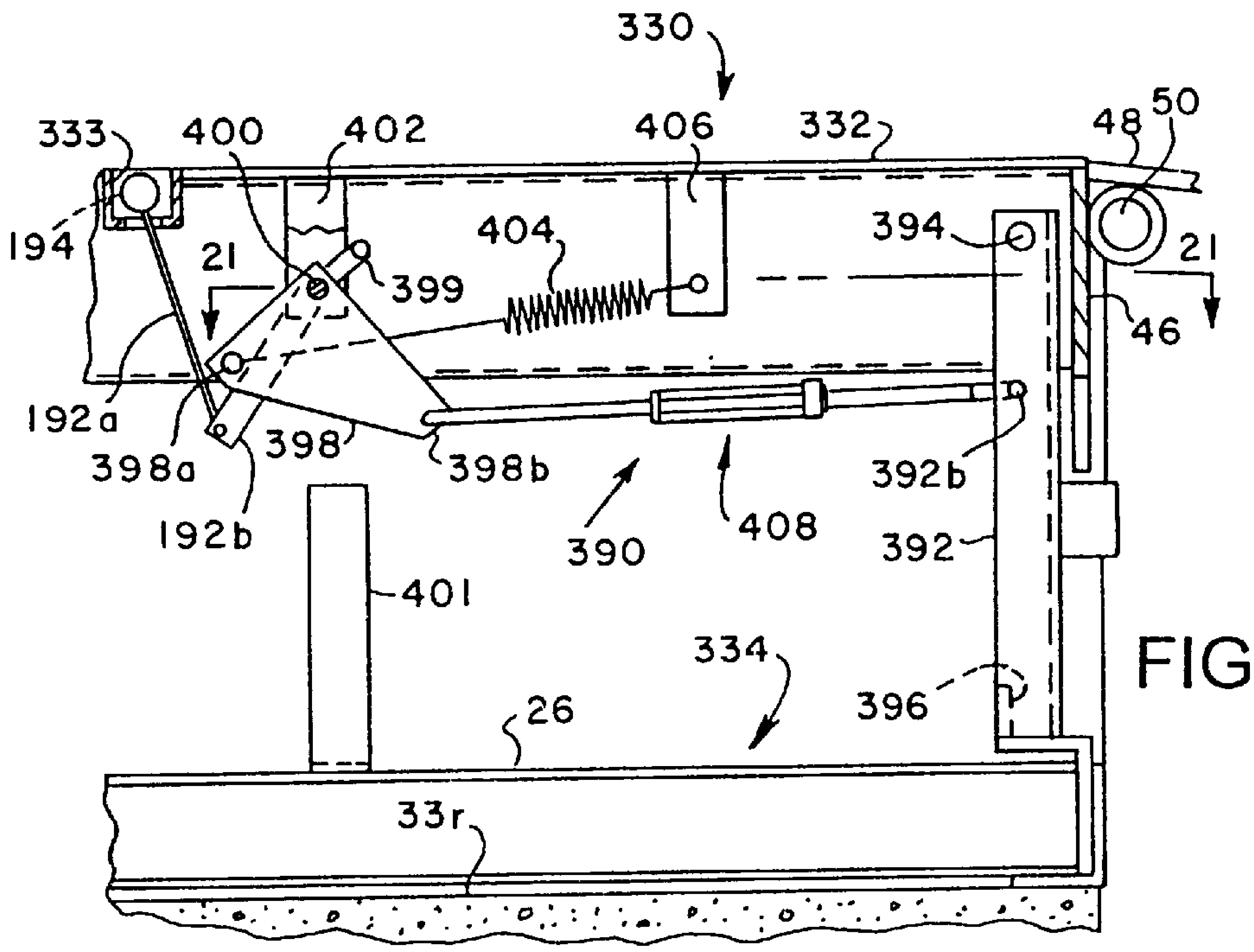
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FIG. 17

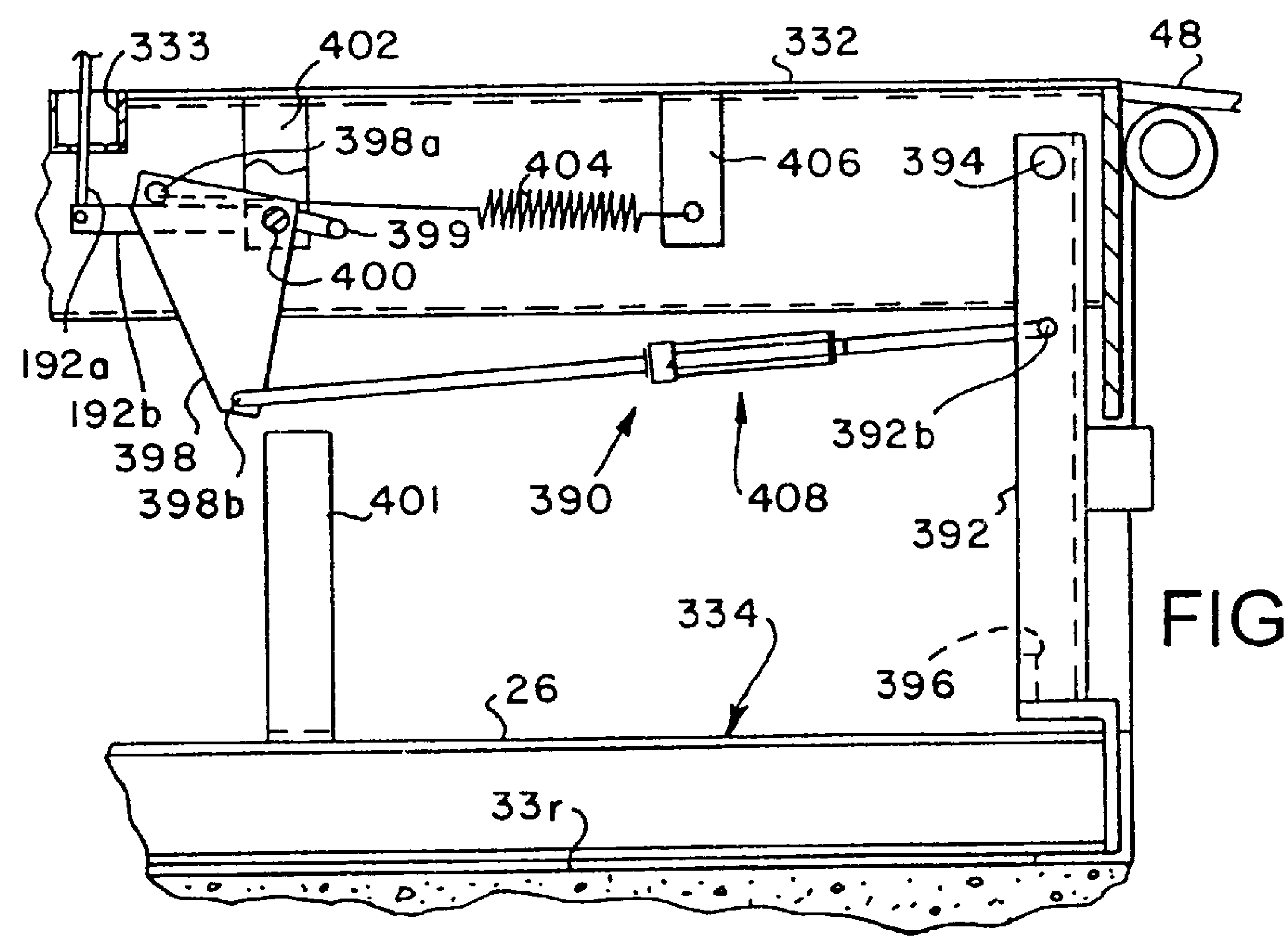
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FIG. 18

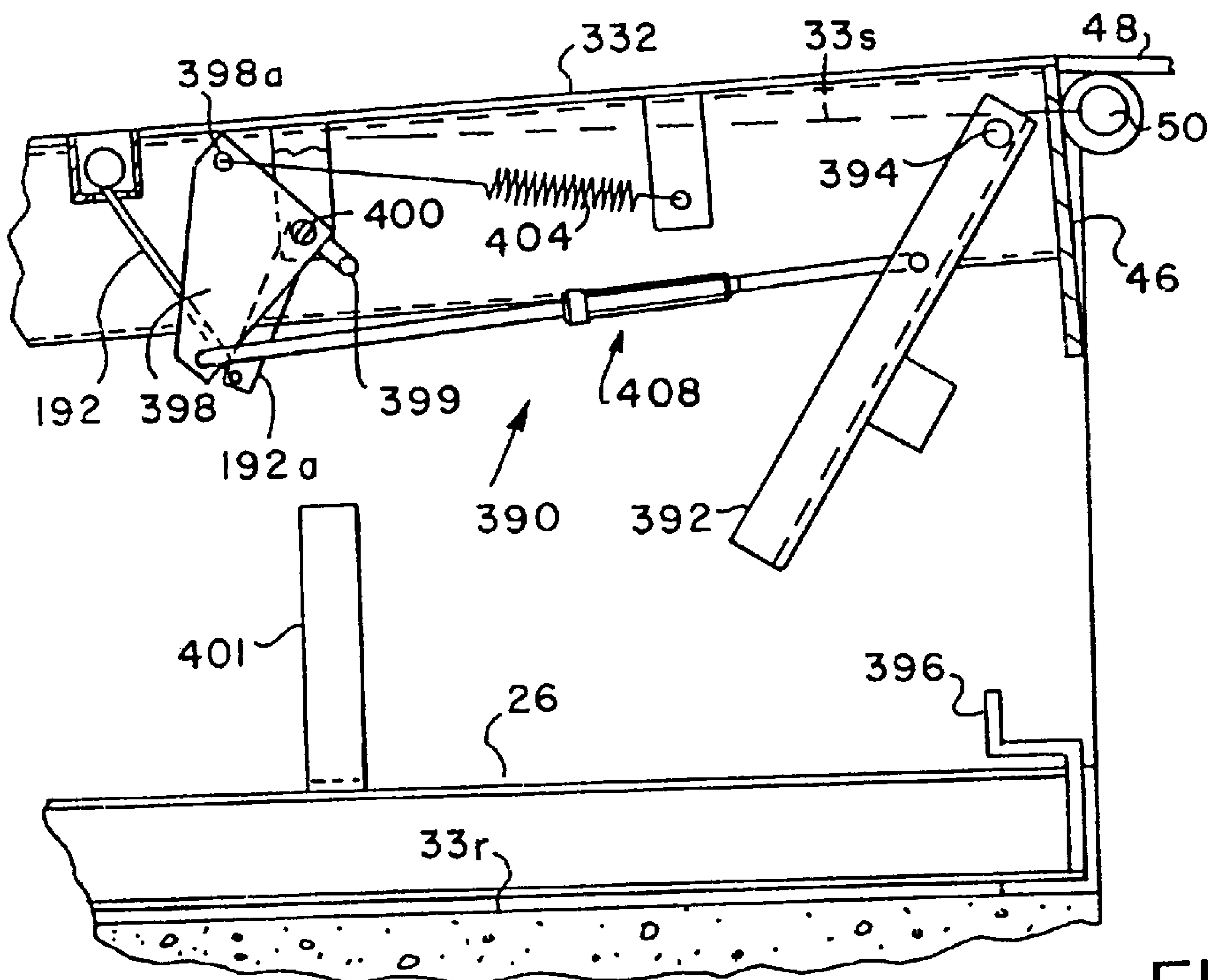
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FIG. 19

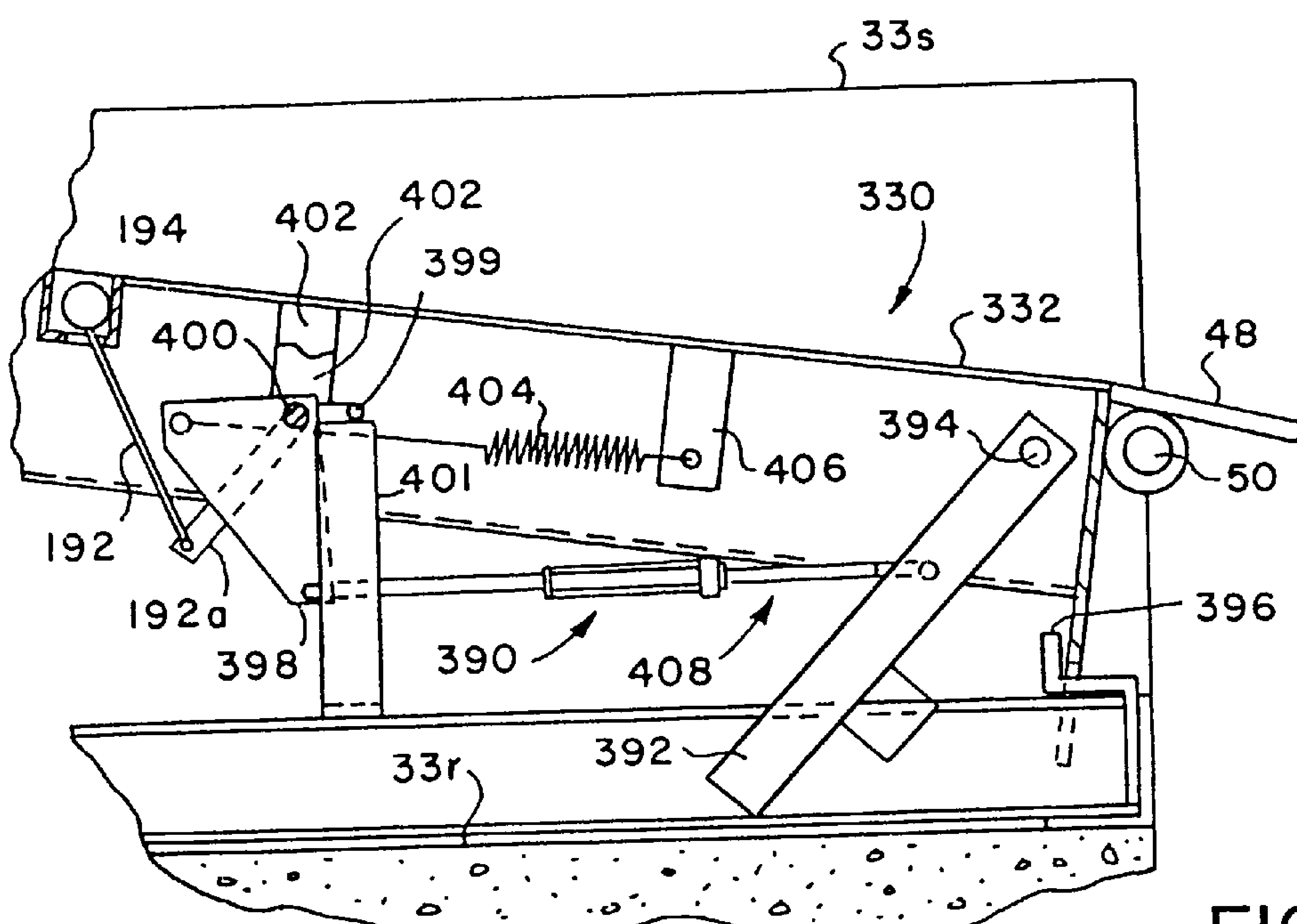
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FIG. 20

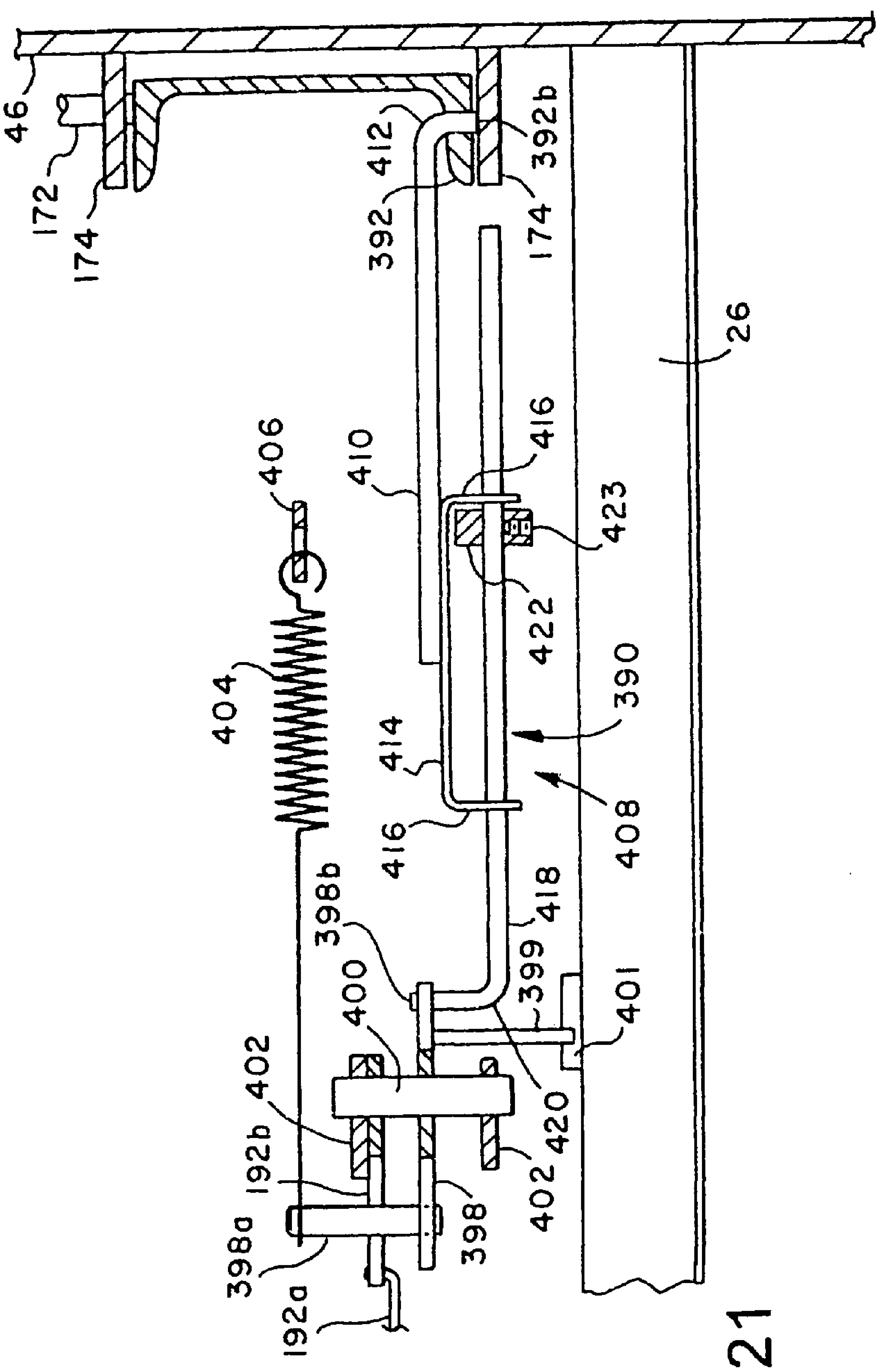
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FIG. 21

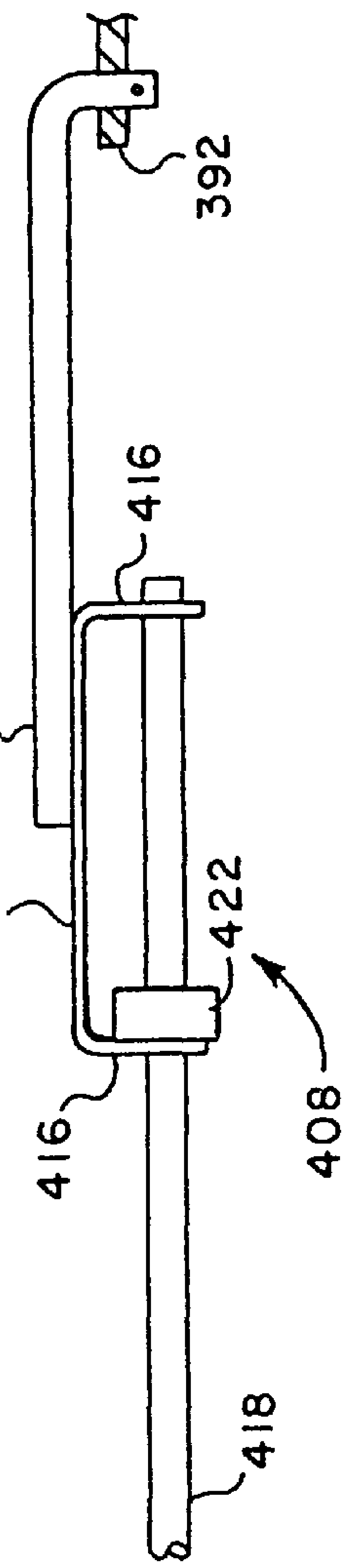
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FIG. 22

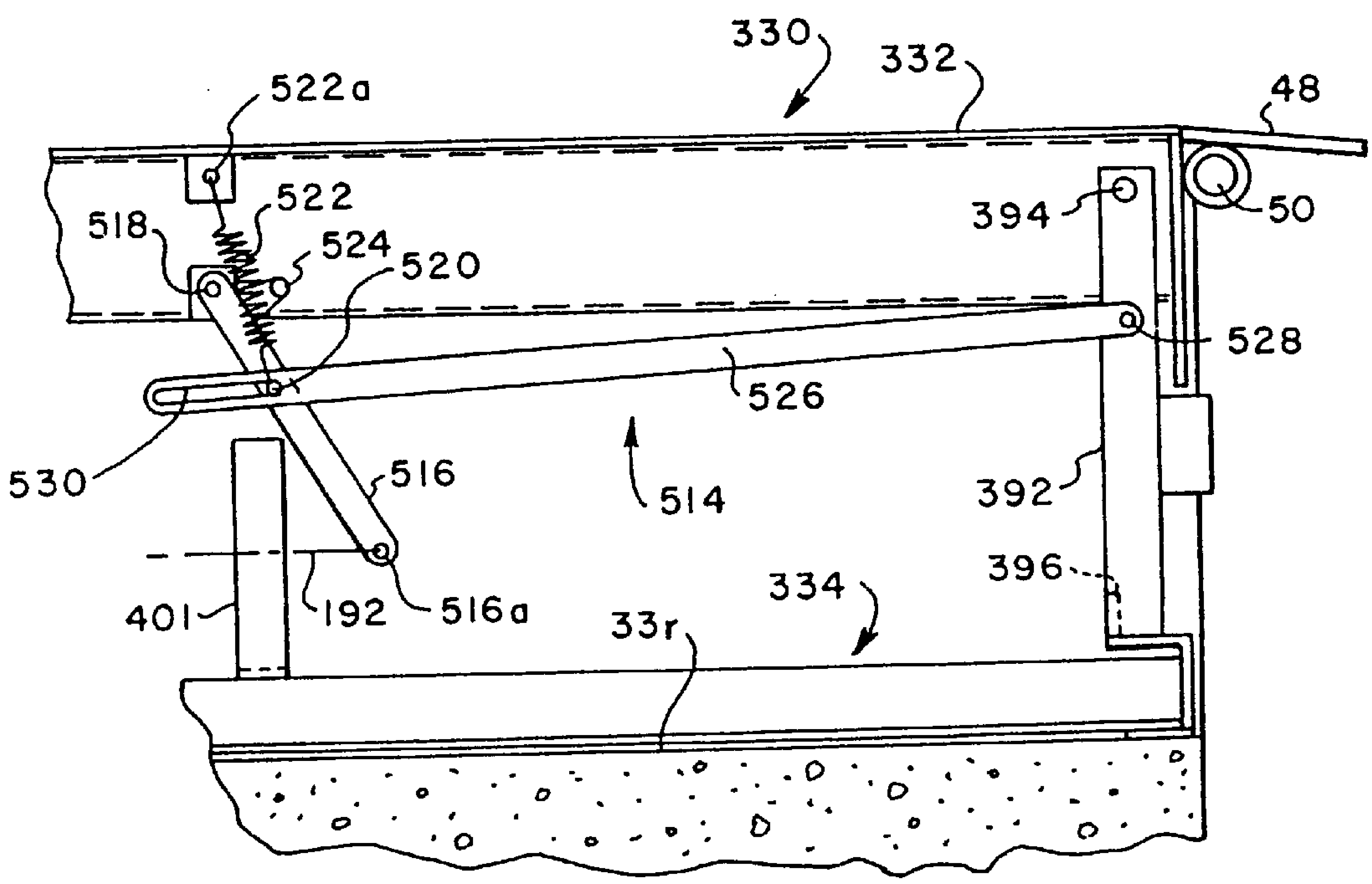

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FIG. 23

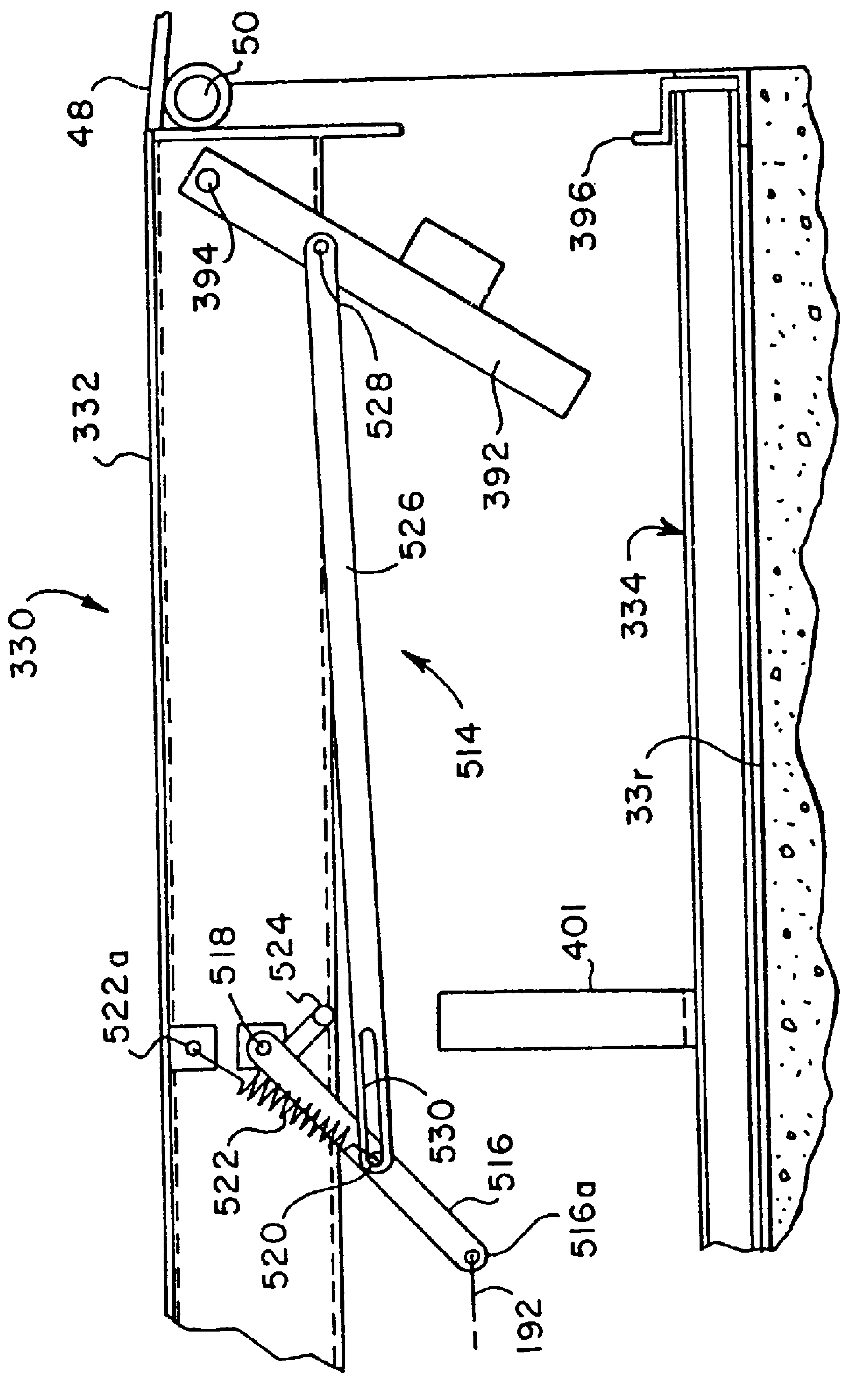
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FIG. 24

DOCK LEVELER

This application is a continuation of prior application Ser. No. 08/714,853 filed Sep. 17, 1996, now U.S. Pat. No. 5,784,740 issued Jul. 28, 1998.

FIELD OF THE INVENTION

The present invention pertains to a dock leveler apparatus comprising a movable ramp disposed between a loading dock and a vehicle to be loaded or unloaded, and including mechanism for moving the ramp to a working position, minimizing rapid movement of the ramp out of a working position and for actuating and latching a hinged extension lip member of the leveler.

BACKGROUND

Dock levelers comprise, generally, hinged ramp structures which are disposed at vehicle loading docks to provide a ramp extending between a vehicle loadbed and the loading dock to facilitate movement of cargo between the dock and the vehicle and to overcome any difference in elevation between the floor of the vehicle loadbed and the dock. Several dock leveler mechanisms have been developed which provide for movement of the dock leveler from an at rest or stored position to a working position connected to a vehicle loadbed, regardless of the loadbed height relative to the loading dock and the leveler structure, at least within an expected range of heights.

Prior art actuating mechanisms for dock leveler ramps and extension lip members are somewhat complex. Moreover, due to the change in height of the vehicle loadbed with respect to the dock during loading and unloading operations, dock leveler actuating mechanisms are subject to rapid wear and unwanted damage as a result of this type of movement.

In spite of the prior development efforts regarding dock leveler mechanisms, there has been a strong felt need to provide an improved actuating mechanism for the hinged ramp type dock leveler. A need has also persisted for a suitable mechanism to minimize rapid movement of the dock leveler, particularly in a downward direction, if the vehicle being loaded is suddenly pulled away from the loading dock. Still further, there has also been a desire to provide improvements in dock leveler mechanisms which provide for extending the hinged lip at the forward edge of the main ramp to a working position, for latching the lip in a working position and for supporting the ramp in a stored position.

It is to these ends that the present invention has been developed.

SUMMARY OF THE INVENTION

The present invention provides an improved dock leveler apparatus, including an actuator for moving the leveler to a working position.

In accordance with one important aspect of the present invention, a dock leveler apparatus is provided including a ramp which is hinged to a support and is operable to be moved between at rest and working positions by an improved actuator which may be remotely controlled and which is also operable to retract out of forcible engagement with the dock leveler ramp to alleviate damage, or wear and tear on the actuator during movement of the ramp while it is working. In particular, the improved dock leveler utilizes a motor operated linear actuator which is operable to retract an actuator member for raising the ramp out of forcible engagement with the ramp after it has moved the ramp to an inclined position which will allow the ramp to then decline to its working position. The actuator includes a mechanism which effectively prevents transfer of movement of the ramp to the actuator mechanism while the ramp is in its working position.

In accordance with another aspect of the present invention, a dock leveler apparatus is provided which includes an improved ramp actuator and a motion damper mechanism which, in combination, provide for improved movement of the dock leveler between stored and working positions, minimize wear and tear on the actuator mechanism and minimize the chance of rapid movement of the leveler ramp downwardly from a working position in the event of movement of a vehicle out of engagement with the leveler. The leveler apparatus includes a pressure fluid cylinder and piston type damper interconnecting the moveable ramp with the leveler frame and operable to control movement of the ramp in a generally downward direction about its hinge axis as a result of the movement of a vehicle away from the loading dock and to which the leveler is connected or, as a result of action which would result in nonsupport of the ramp.

The present invention also provides a dock leveler and an improved arrangement of a linear actuator with a first counterbalance spring mounted on the actuator mechanism and a second counterbalance spring arrangement connected between the dock leveler ramp and the apparatus frame and wherein at least the second counterbalance spring is adjustable for adjusting the counterbalance force acting on the leveler ramp.

The present invention still further provides a dock leveler apparatus which includes improved mechanisms for extending a lip member hinged to the forward edge of the leveler ramp, latching the lip member in a desired position and providing for movement of ramp support legs to a retracted position in the event that it is desired to move the ramp to a working position below dock level.

Those skilled in the art will further appreciate the abovementioned features of the invention together with other superior aspects thereof upon reading the detailed description which follows in conjunction with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a perspective view of a dock leveler apparatus in accordance with the invention;

FIG. **2** is a section view taken generally along the line **2—2** of FIG. **1**;

FIG. **3** is a detail section view taken along the line **3—3** of FIG. **2**;

FIG. **4** is a detail section view, similar to FIG. **3**, showing an alternate embodiment of the actuator mechanism for the apparatus of the present invention;

FIG. **5** is a section view taken generally along line **5—5** of FIG. **1**;

FIG. **6** is a detail view showing certain features of the lip extension linkage shown in FIG. **5**;

FIG. **7** is a view taken in the same plane as FIG. **5** showing the leveler apparatus in a working position;

FIG. **8** is a section view taken generally along line **8—8** of FIG. **1**;

FIG. **8A** is a detail section view of the lip latch member;

FIG. **9** is a detail front elevation of the ramp showing additional features of the lip latch mechanism;

FIG. **10** is a side elevation of the apparatus of FIG. **1** showing certain features of a ramp support leg retraction mechanism;

FIG. **11** is a view similar to FIG. **10** showing the ramp support legs retracted;

FIG. **12** is a schematic diagram of a control system for the apparatus of the invention;

FIGS. **13** and **14** are side elevations of a first alternate embodiment of the dock leveler apparatus of the invention in two operating positions, respectively;

FIG. **15** is a side elevation, partially sectioned, of a second alternate embodiment of a dock leveler apparatus in accordance with the invention;

FIG. **15**A is a longitudinal central section view of another embodiment of a linear actuator;

FIG. **16** is a view taken generally from the line **16—16** of FIG. **15**;

FIGS. **17** through **20** are partial side elevation views of a dock leveler apparatus in accordance with the invention including a first alternate embodiment of a ramp support leg retraction mechanism;

FIG. **21** is a view taken from line **21—21** of FIG. **17**;

FIG. **22** is a detail view showing an alternate position of a lost motion coupling for the leg retraction mechanism shown in FIGS. **17** through **21**; and

FIGS. **23** and **24** are partial side elevations of a second alternate embodiment of a ramp support leg retraction mechanism in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the description which follows like parts are marked throughout the specification and drawing with the same reference numerals, respectively. The drawing figures may not necessarily be to scale and certain elements may be shown in somewhat generalized or schematic form or omitted from certain ones of the drawing figures in the interest of clarity and conciseness.

Referring primarily to FIG. **1**, a dock leveler apparatus in accordance with the invention is illustrated and generally designated by the numeral **20**. The apparatus **20** includes a support frame **22** of generally conventional construction including a transverse, front, angle cross section member **24**, two longitudinal channel shaped beams **26** extending transversely to the member **24**, intermediate transverse members **28** and **30** and a rear, transverse, angle cross section member **32**. Upstanding column members **34** are spaced apart and suitably welded to the transverse member **32**. Suitable gussets **35** are also interposed between the inboard column members **34** and the longitudinal beam members **26**, as shown, and are preferably suitably welded thereto. The column members **34** also support a ramp hinge plate **38** substantially coextensive with the frame member **32** and supporting suitable hinge means **39** for hingedly connecting a generally planar elongated deck or ramp member **40** to the frame **22**. The frame **22** is adapted to be mounted in a suitable generally rectangular pit or recess **33**r formed at a loading dock **33**, FIG. **2**, for example.

The ramp **40** is reinforced by spaced apart, longitudinal beams **42**, several shown in FIGS. **1** and **2**, extending between a rear face plate **44** and a front face plate **46**, only a small portion of which is shown in FIG. **1**. The face plate **46** extends across the front or forward edge **41** of the ramp **40** and supports spaced apart tubular hinge members **41*a*** which cooperate with hinge members **41*b*** secured to the rear edge **43** of a generally planar lip member **48** forming an extension of the ramp **40**. An elongated hinge pin **50** extends through the tubular hinge members **41*a*** and **41*b*** to form a somewhat conventional hinge connection between the ramp **40** and the lip **48**. Other hinge constructions may be utilized in place of that shown in the drawing figures hereof. Elongated side plates or toe guards **52** are secured to the ramp **40** along its respective side edges normal to the forward edge **41**, generally as shown in FIG. **1**.

Referring further to FIG. **1**, and also FIG. **2**, the dock leveler apparatus **20** also includes a unique actuator, generally designating by the numeral **56**, for moving the ramp **40** between a substantially horizontal, at rest position and a raised position, as shown in FIG. **2**, preparatory to moving the ramp to a working position, such as shown in FIG. **7**. The actuator **56** is of a generally linear type and is characterized by an elongated rotatable power screw member **58**, FIG. **2**, which is engageable with a nut **60**, secured to one end of an elongated cylindrical linearly extensible tube member **62**. The screw **58** is drivenly connected to a suitable electric motor **64** which, through a gear type speed reduction drive mechanism **66**, is operable to rotate the screw **58** in opposite directions to cause the actuator member **62** to linearly extend relative to a support tube **63** and to cause the ramp **40** to move about a pivot axis provided by the hinge means **39** to an extended position, generally as shown in FIG. **2**. The support tube **63** is suitably connected at its lower distal end to a housing **67** for the gear reduction mechanism **66**. A generally circular flange **69** is disposed about the lower end of tube **63**. A third outer support tube **70** is disposed in sleeved relationship over the tube **63** and is also operably connected to the actuator extension tube member **62** in a manner to be described herein.

Referring further to FIGS. **2** and **3**, the actuator support tube **70** includes a transverse head portion **74** having a boss **76** formed thereon and operable to form a pivot connection between the ramp **40** and the actuator **56** at the face plate **46**, thanks to the provision of a clevis **77** and clevis pin **78**, as shown in FIG. **3**. A generally cylindrical flange member **80** is sleeved over the tube **70** in slidable relationship thereto and engages one end of an elongated coil compression spring **82** which is disposed between the flange **80** and the flange **69** and sleeved over the tubes **63** and **70**. A transverse pin **84** extends through opposed, elongated, longitudinal slots **86** formed in the tube **70**. The pin **84** is also secured to the distal end of the actuator tube member **62** so that, when this member is extended by rotation of the screw **58** in registration with the nut **60**, the flange **80** will be extended toward head portion **74** of tube **70** until the pin **84** engages the upper ends of the slots **86** and causes the tube **70** to raise the ramp **40**, for example. The screw **58** may be rotated in the opposite direction to retract the extensible tube member **62** in sleeved relationship within the support tube **63**, compressing the spring **82** as the flange **80** moves toward the flange **69**. This action leaves the tube **70** free to move in a reciprocal telescoping fashion with respect to the tube **63** if, for example, the ramp **40** is caused to move up and down about its hinge means **39**. Such action by the ramp **40** may occur frequently in response to movement of a vehicle loadbed relative to dock **33**, at which the apparatus **20** is disposed in a conventional manner. Accordingly, in response to rotation of the screw **58** in one direction by the motor **64**, the nut **60** and extensible actuator tube member **62** is extended outward from the tube **63** until the pin **84** engages the ends of slots **86** in tube **70** and raises the ramp **40** about its hinge means **39**. At any time, the actuator **56** may be reversed to cause the tube member **62** and flange **80** to retract toward the housing **66** thereby allowing the tube **70** to move in telescoping relationship over the support tube **63**, at will.

By compressing the spring **82** between the flanges **69** and **80**, the ramp extension tube **70** and ramp **40** are free to move downward under the weight of the ramp but controlled by a damper mechanism to be described in further detail herein. The arrangement of the pin **84** connected to the tube member **62** and slidable in the slots **86** also prevents rotation of the extension tube member **62** as it translates linearly in and out of the tube **63** in response to rotation of the screw **58**. The actuator **56** is also pivotally connected to the frame **22** at the housing **66** by a suitable clevis type pivot connection **88**, FIG. **2**.

Referring briefly to FIG. **4**, an alternate embodiment of the actuator **56** and its structure for connection to the ramp **40** is illustrated wherein the tube **70** is replaced by a tube **70***a* having a transverse flange **80***a* formed integral with or secured to the tube **70***a* at one end. Flange **80***a* includes a boss **76***a* forming part of a pivot connection using the clevis **77** and the clevis pin **78** in the same manner as the embodiment of FIG. **3**. The actuator extension tube **62** is disposed in telescoping relationship within tube **70***a* and the transverse actuator pin **84** is disposed in opposed elongated slots **86***a* in the tube **70***a*. The counterbalance spring **82** is disposed in sleeved relationship around the tube **70***a* in substantially the same manner as the embodiment of FIG. **3**. However, the spring **82** is disposed between the flanges **80***a* and **69** and exerts a constant upward biasing force on the ramp **40** to counterbalance the weight of the ramp regardless of the position of the extensible tube member **62**.

Accordingly, in the embodiment of FIG. **4**, when the actuator motor **64** is operated to rotate screw **58** and cause extension of the tube **62** the ramp **40** will be raised when the pin **84** engages the tube **70***a* at the outer distal ends of the slots **86***a* with the assistance of the force exerted by the counterbalance spring **82**. When the actuator tube **62** is retracted, in response to rotating the screw **58** in the opposite direction, the tube **70***a* is free to telescope over the tube **63** to allow movement of the ramp **40** without imposing any damaging forces on the actuator tube member **62**, the nut **60** or the screw **58**. However, the biasing effort of the counterbalance spring **82** is constantly urging the ramp **40** to pivot in a counterclockwise direction, viewing FIG. **2**. Moreover, as with the embodiment of FIGS. **2** and **3**, the actuator arrangement of FIG. **4** allows the ramp **40** to undergo oscillatory movement during loading and unloading operations without imposing damaging forces on the linear actuator **56**. Another advantage of the actuator **56** resides in mechanism provided by the screw **58** and nut **60** wherein, as the nut **60** is advanced to the distal end of the screw **58**, a free wheeling effect is provided which prevents damage to the actuator once it has extended the ramp as far as it is capable of doing. A preferred type of actuator which includes this feature is available from Motion Systems Corporation, Eatontown, N.J., as one of their 85199/85200 series ball drive actuators.

Referring again to FIGS. **1** and **2**, the dock leveler **20** also includes a unique arrangement of a hydraulic motion damper **92** for damping the movement of the ramp **40** about the hinge **39** in a clockwise direction, viewing FIG. **2**. The damper **92** comprises a hydraulic piston and cylinder actuator mechanism including a conventional cylinder member **94** in which is slidably disposed a piston **96** dividing the cylinder into opposed chambers **94***a* and **94***b*, FIG. **2**, in a conventional manner. The piston **96** is connected to an elongated extensible piston rod **98** which is connected at its distal end to the frame member **30** at a clevis type pivot connection **100**. The opposite end of the actuator **92** is pivotally connected to the ramp **40** at a suitable pivot connection **102**. A quantity of hydraulic fluid is charged to the cylinder **94** for transfer between the opposed chambers **94***a* and **94***b*. The damper **92** is preferably aligned with actuator **56** midway between opposite sides of the ramp **40**, as shown, and disposed between actuator **56** and hinge means **39**.

Fluid is transferred between chambers **94***a* and **94***b* by way of conduit means **104**, FIG. **2**, through a circuit including a so called velocity fuse **106** shown schematically in FIG. **2**, a flow restricter **108** and a bypass check valve **110** also interposed in the circuit. The circuit is somewhat exemplary but provides means for damping the motion of the ramp **40** in a downward direction about the pivot axis formed by the hinge **39**. For example, when the ramp **40** is raised by the actuator **56** fluid is transferred from chamber **94***a* at the piston rod end of cylinder **94** to chamber **94***b* at the end at which the clevis **102** is disposed, by way of the circuit just described, including the check valve **110**, which is operable to open to minimize any resistance to fluid flow.

However, when fluid is urged to flow out of chamber **94***b* toward chamber **94***a* it must pass through the velocity fuse **106** and the flow restricter **108**. The flow restricter **108** is normally sufficient to throttle flow of fluid out of chamber **94***b* to retard the motion of the damper **92** as the piston **96** telescopes into the cylinder so that the ramp **40** moves downwardly relatively slowly such as under a condition wherein the loadbed of the vehicle being loaded or unloaded moves up and down in response to changing load conditions. However, in a situation where, for example, the vehicle in engagement with the leveler **20** should suddenly move away from the loading dock **33**, the weight of the ramp **40** may be such as to cause relatively rapid downward movement, even with the flow restricter **108** in the circuit provided by the conduit **104** and even though all flow is forced through the restricter **108** by closure of the check valve **110**.

In such circumstance just described the velocity fuse **106** will, at a certain fluid flow rate, close to arrest movement of the ramp **40** downwardly, thus minimizing the risk of a person, persons or a vehicle on the ramp **40** from being pitched off of the ramp due to any violent or rapid downward movement. The velocity fuse **106** may, for example, comprise a closure member **106***a* having a biasing spring **106** *b* which normally holds the closure member at least slightly open to allow fluid flow from chamber **94***b* toward chamber **94***a*. However, at a certain rate of fluid flow through conduit **104** fluid pressure forces acting on the closure member **106** *a* will overcome the urging of the biasing spring **106** *b* and cause the closure member to engage a seat **106***c* to totally shut off flow between the chambers **94***b* and **94***a*, as long as a sufficient pressure differential exists across the closure member. The particular configuration of the motion damper **92** is advantageous. However, a conventional automotive type suspension shock absorber may also be used as a motion damper for the ramp **40**. Moreover, damper **92** may be controlled by a suitable hydraulic circuit to lock ramp **40** in a selected position.

Referring now to FIGS. **1**, **5**, **6** and **7**, the dock leveler **20** includes a mechanism for extending the lip **48** from a depending position, as shown in FIGS. **1** and **5**, to an extended position as shown in FIG. **7** whereby the lip may be utilized to engage a loadbed **49**, FIG. **7**, comprising, for example, the loadbed of a trailer of a motor truck disposed at the dock **33**. Accordingly, the ramp **40** and lip **48** form a pathway for transferring cargo between the dock **33** and the loadbed **49**. The extension mechanism is generally designated by the numeral **110** and includes a toggle linkage including a first link **112** pivotally connected to one of the frame members **26** at a pivot connection **114**. A second link **116** is pivotally connected to link **112** at a pivot connection **118** and link **116** is connected to a third link **120** which is pivotally connected to the lip **48** at a pivot connection **122** secured to a gusset **123** suitably welded to the lip **48** at one of the hinge tubes **41**_b_, for example, as shown.

The relationship between links **116** and **120** is further illustrated in FIG. **6**. The link **120** includes an elongated, generally cylindrical rod portion **121** which is adapted to be telescopically slidably disposed in the tubular link **116** and held in engagement therewith by opposed tension coil springs **125** connected to the link **120** and to the link **116** at their opposite ends, as indicated at **125**_a_ and **125**_b_, respectively. Moreover, as shown in FIG. **5**, the link **112** includes a position adjustment pin **113** mounted thereon and engageable with the frame member **30** to limit the movement of the link **112** in a clockwise direction about its pivot connection **114**, viewing FIG. **5**. The pin **113** may comprise a threaded member such as a lockable bolt supported on a boss **113**_a_ secured to link **112** and operable to be rotated to adjust the effective length of the pin **113** and thus the pivotal position of link **112** about the pivot axis formed by the pivot connection **114**.

In the position of the ramp **40** shown in FIGS. **1** and **5**, the ramp has been raised from a generally horizontal stored position to a position from which the ramp may be lowered into engagement with loadbed **49**, for example. As the ramp **40** is raised by the actuator **56**, not shown in FIGS. **5** or **7**, the lip **48** will be in a generally depending position, as shown in FIG. **5**, and the extension linkage **110** will move to the position shown in FIG. **5** with the pivot connection **118** being slightly downwardly over center with respect to a straight line between pivot connections **114** and **122**. If the ramp **40** is raised to a point exceeding the depending limit position of the lip **48** which the maximum length of the mechanism **110** is capable of achieving, the link **120** may telescope or extend partially out of the link **116** until the ramp is brought back to the position shown in FIG. **5**. The link **120** will remain engaged with the link **116**, however.

As the ramp **40** is lowered by movement in a clockwise position about the hinge **39**, viewing FIG. **5**, the lip extension mechanism **110** will urge the lip **48** to pivot in a counterclockwise direction about hinge **50** to move to the position shown in FIG. **7** with respect to the plane of the ramp **40**. As the ramp **40** moves downwardly toward the working position shown in FIG. **7** the mechanism **110** will undergo a toggle type actuation and the pivot connection **118** will go overcenter in the opposite direction or upwardly until the links **112** and **116** assume the general position shown in FIG. **7**.

Once the links **112** and **116** go over center the lip **48** may move to a depending position rather rapidly except for the provision of a latch mechanism to be described hereinbelow. However, if loadbed **49** or other structure is disposed below the distal edge **48**_e_ of the lip **48**, the lip will engage such structure and assume a working position. Moreover, once a structure, such as the loadbed **49** is removed from engagement with the lip **48** it will pivot downwardly to its depending position since the mechanism **110** is not in a position to urge the lip to extend outward from the ramp **40**. Bumpers **48**_f_, FIG. **1**, are operable to engage lip **48** when it swings downward as just described.

As shown in FIG. **7**, for example, if loadbed **49** moves away from the lip **48** it will pivot in a clockwise direction, viewing FIG. **7**, to its depending position as the link **112** moves counterclockwise to allow link **116** to move with the movement of the lip. When the ramp **40** is subsequently raised by the actuator **56** during a new operating cycle, the linkage **112, 116** will initially move back to the position shown in FIG. **5** so that, as the ramp **40** is again lowered from the position shown in FIG. **5** toward the position shown in FIG. **7**, the mechanism **110** will be effective to initially raise the lip **48** until the pivot connection goes "over center" and then allow the lip **48** to move into engagement with the loadbed **49**.

In the view of FIG. **7**, only the lip extension linkage **110** is shown connected to the ramp **40** and other mechanism described hereinabove and hereinbelow has been omitted in the interest of clarity. Moreover, the position of the ramp **40** and the lip **48** shown in FIG. **7** is somewhat exemplary of one of several working positions which the ramp and lip may assume when forming a path for traffic between the dock **33** and the loadbed **49**.

Referring now to FIGS. **1**, **8**, **8**A and **9**, the lip **48** is operable to be latched in a position, as indicated in FIG. **8**, to facilitate operation of the leveler **20** when moving to a working position. A latch mechanism including a latch member **130** is suitably secured to the lip **48** including one of its hinge members **41**_b_, for example. The latch mechanism also includes an elongated latch bar assembly **132** which includes an elastically bendable latch bar **134** secured to the underside **40**_a_ of ramp **40** by a suitable bracket **135** and a pivot pin connection **137**. The opposite end of the latch bar **134** is connected to a latch member comprising a resiliently deflectable bar **136** having a distal end **136**_a_ which is operable to be engaged with a notch **138** formed in the latch member **130**. Latch member **136** is suitably secured to the latch bar **134** by a bracket **139** allowing the latch member **136** to be supported in cantilever fashion projecting through a suitable slot **46**_b_ formed in the ramp face plate **46**.

As shown in FIG. **9**, the latch member **136** is biased into a position to engage the latch member **130** by a lever **142** which is mounted on a pivot pin **144** secured to the face plate **46**. The opposite end of the lever **142** includes a boss **146** secured to one end of flexible means, such as a chain **148**, the opposite end of which is connected to a counterweight bar **150**, see FIG. **8**. The bar **150** is pivotally connected to the frame member **28** at a pivot connection **152** and is free to move about the pivot connection to exert the influence of its weight on the lever **142** to bias the latch bar assembly **132** in a generally upward or counterclockwise direction, viewing FIG. **8**, about the pivot connection **137** formed between the bar **132** and the bracket **135**. Upward biasing movement of lever **142** may be limited by a stop **46**_c_, FIG. **9**, on face plate **46**.

Referring to FIG. **8**A, the latch member **136** is mounted on the bracket **139** for pivotal movement about a pivot pin **139**_a_ and is normally biased from movement in a clockwise direction by the lever **142**. Moreover, the latch member **136** is limited in its movement in a counterclockwise direction with respect to bracket **139**, viewing FIG. **8**A, by an adjustable stop member **136**_b_ comprising a threaded fastener which is engageable with a stop boss **139**_b_ formed on bracket **139**. The pivot stop formed by the members **136**_b_ and **139**_b_ allow for adjustment of the position of the latch member **136** which will provide for engagement with the latch member **130** at the notch **138**. This adjustment feature is also operable to control the amount of deflection of the latch bar **134** which will result in pivotal movement of the latch member **136** to cause disengagement from the latch member **130**.

When the ramp **40** and lip **48** are moved to the position shown in FIG. **8** by the actuator **56** and the lip extension mechanism **110** the counterweight **150** and chain **148** pivot the lever **142** to a position to bias the latch bar assembly **132** into a position such that any movement of the lip **48** in a clockwise direction, viewing FIG. **8**, about its hinge pin **50** will cause the latch member **130** to engage the latch member **136** to hold the lip **48** in a substantially extended position, as shown in FIG. **8**. This position will be maintained until one of three conditions is encountered.

For example, when a force of approximately one hundred pounds is applied to the distal edge **48***e* of the lip **48**, resilient latch bar **134** is caused to deflect or bow upwardly, viewing FIG. **8**, to cause the latch member **136** to move out of the notch **138** in latch member **130** allowing the latch member **130** to pivot over the latch member **136** and allowing the lip **48** to pivot about its hinge to a depending position.

A second condition which will cause disengagement of the latch members **130** and **136** arises when the lip **48** engages a loadbed such as the loadbed **49** in a normal working position of the lip. In this position the counterweight **150** has rotated to an at rest position on the frame **22** thereby substantially reducing any effort by the lever **142** to bias the latch bar assembly **132** in a counterclockwise direction, viewing FIG. **8**. In fact, the weight of the latch bar assembly **132** under such condition is enough to allow the latch bar to pivot downwardly out of a position which could cause member **136** to engage latch member **130**. Accordingly, once a loadbed such as the loadbed **49** moves away from the lip **48** when it is in a working position, such as shown in FIG. **7**, for example, the lip is free to rotate to a depending position similar to that shown in FIG. **1**.

A third condition under which the latch members **130** and **136** will disengage is when the dock leveler ramp **40** pivots clockwise below the level or plane of dock **33**, as indicated by the surface **33***s* in FIG. **1**, under which circumstance the latch member **136** will engage an upstanding latch release member **158**, see. FIG. **1**, causing deflection of the latch member **136** sufficient to disengage it from the latch member **130** in a manner similar to that described above, that is, causing the latch bar **134** to bow or deflect sufficiently to move the latch member **136** out of engagement with the latch member **130** and allowing the lip **48** to pivot to a depending position. Again, once the ramp **40** is raised by the actuator **56** and the extension mechanism **110** moves the lip **48** to an extended position the latch **136** is returned to a position such that it will engage the latch member **130** upon movement of the lip **48** in a clockwise direction, viewing FIG. **8**.

Referring again to FIG. **1**, the dock leveler **20** also includes two depending support legs **170** which are spaced apart from each other and pivotally supported on the ramp **40** adjacent to the legs forward edge **41**. The legs **170** support the bumpers **48***f*, respectively, and the legs are interconnected by an elongated member **172**. The legs **170** are preferably formed of channel shaped cross section members and are each supported between spaced apart depending support brackets **174** having pivot pins **176** extending therebetween and engaged with the legs **170**, see FIG. **10** also. The legs **170** are engageable with respective L-shaped brackets **171**, FIG. **1**, suitably secured to the forward frame member **24** as shown in FIGS. **1** and **10**. The brackets **171** have upstanding lip portions **171***a* which are operable to be disposed between the flanges of the channel shaped legs **170** and the brackets also engage leg distal ends **170***a* to support the ramp **40** in a position substantially coplanar with the surface **33***s* of the dock **33**.

Referring now to FIGS. **10** and **11**, the dock leveler lip **48** is shown removed from the ramp **40** in the interest of clarity and a support leg retraction mechanism is illustrated and generally designated by the numeral **180**. The mechanism **180** is operable to retract the legs **170** into the position shown in FIG. **11** so that the ramp **40** may be dropped to a declined, below dock position, as shown, for operation to connect the dock leveler with a vehicle, not shown, having a low loadbed height, for example.

Referring further to FIGS. **10** and **11**, each of the legs **170** includes a transverse rearwardly extending arm **182** disposed between the lower distal end **170***a* of the leg and pivot pin **176**. A coil tension spring **184** is interconnected between distal end of arm **182** and face plate **46**, as shown. An actuating link **186** is supported on the ramp **40** by a depending support member **188** secured to one of the longitudinal beams **42**, as shown in FIG. **10**, and supporting the link **186** for pivotal movement about a pivot axis formed by suitable pivot pin means **186***a*. The link **186** includes a first arm portion **186***b* extending on one side of the pivot pin **186***a* and a second arm **186***c* extends in the opposite direction from pivot pin **186***a*. A transverse depending arm portion **186***d* is formed at the distal end of arm **186***c*. A coiled tension spring **190** is secured at its opposite ends to the distal end of arm **186***b* and at a point adjacent distal end **170***a* of one of the legs **170**, as shown. The link **186** is normally in the position indicated by alternate position lines in FIG. **10** whereby the spring **190** exerts insufficient force to overcome the force of springs **184** which tend to hold the legs **170** in a position which will support the ramp **40** as shown in FIG. **10**.

However, the distal end of arm **186***b* is connected to a flexible lanyard **192** which may extend through an opening in ramp **40** and connected to a suitable member **194** disposed above the ramp and which may be grasped to pull on the link **186** to move it in a clockwise direction, viewing FIG. **10**. The spring **190** is stretched as the link **186** is moved to the position shown by the solid lines in FIG. **10** and engages a stop pin **196** supported on the beam **42**. In the above-described position of link **186**, the spring **190** has been stretched to increase its tension sufficiently to overcome the bias of the springs **184**. Under these conditions, once the ramp **40** is elevated sufficiently above the brackets **171**, **171***a* to provide clearance for the distal end **170***a* of legs **170** the legs are moved to the position shown in FIG. **11** whereby the ramp **40** may be declined to the position shown in FIG. **11** to provide a path between the dock **33** and a loadbed, not shown.

When the legs **170** move to the position shown in FIG. **11**, the tension in spring **190** is relaxed sufficiently to allow link **186** to move to the position shown. Also, when the ramp **40** declines to the position shown in FIG. **11** the link **186** may be rotated by engagement of distal end of arm portion **186***d* with a frame member **26** back to the position shown. In this position of link **186** the spring **190** exerts a reduced force acting on the legs **170**. Thus, when the ramp **40** is moved upwardly, in a counterclockwise direction about hinge **39**, viewing FIG. **11**, the springs **184** will move the legs **170** back to the position shown in FIG. **10** with respect to the ramp **40** so that the legs may be operable to support the ramp in the position shown in FIG. **10**.

Referring now to FIG. **12**, there is illustrated an a.c. electrical control circuit for operating the actuator **56**, including the motor **64** indicated in FIG. **12**. The reversible a.c. motor **64** is in circuit with a switch **200** and a relay **202** which is controllable by a timer **204**. An emergency stop switch **206** is also interposed in the circuit, as illustrated. On movement of the switch **200** to the alternate position from that shown in FIG. **12**, the motor **64** is operated in the forward or raise direction of the ramp **40**. When the ramp **40** is raised to a desired position, such as illustrated in FIGS. **1** and **2**, preparatory to being lowered into a position to engage a loadbed, switch **200** is moved to the position shown and the timer circuit **204** is activated. The switch **200** is normally biased in the position shown in FIG. **12** to open the circuit which drives the motor **64** in the direction to raise the ramp **40**. When the actuator **201** for the switch **200** is released, the switch moves to the position shown in FIG. **12** to cause the motor **64** to be energized in the reverse direction to retract the actuator extension tube **62**, FIG. **2**. The switch contacts **203** are also opened which starts operation of the timer circuit **204** and after a predetermined time, say about thirty seconds, the timer circuit causes relay **202** to open to deenergize motor **64**. The timer circuit **204** may be adjustable so that the time during which the relay contacts **202** are closed and the motor **64** is operated in the direction which lowers the extension tube **62** may be adjusted to assure that the actuator is sufficiently retracted to not interfere with or be damaged by movement of the ramp **40** in an oscillatory manner, for example, as previously described.

During raising of the ramp **40** to the position shown in FIG. **2** from a position such as that shown in FIG. **10**, for example, the legs **170** will remain in the position of FIG. **10** unless the actuator member **186** is moved to the position shown in FIG. **10** from its alternate position shown by the alternate position lines in FIG. **10**. Moreover, as the ramp **40** is raised to the position shown in FIG. **2** the lip extension linkage **110** will typically move from the position shown in FIG. **7** to the position shown in FIG. **5** so that, upon commencing to lower the ramp **40**, the lip **48** will be moved in a counterclockwise direction, viewing FIG. **5**, about the hinge pin **50** so that the lip may engage the loadbed **49** when the ramp **40** has been moved to the position of FIG. **7**. Thanks to the toggle links **112** and **116** and the above-described latch mechanism, lip **48** will remain extended until the ramp **40** is lowered to a predetermined position and the pivot **118** moved over center from the position shown in FIG. **5** to a position similar to that shown in FIG. **7**. The lip **48** will also be maintained in its extended position by the latch mechanism described above and shown in FIGS. **8** and **9** until the lip **48** engages the loadbed **49** and the counterweight **150** has come to rest to reduce tension on the chain **148**.

If it is desired to retract the legs **170** prior to lowering the ramp **40** to a position such as shown in FIG. **11**, the lanyard **192** is pulled to move the link **186** to the position shown in FIG. **10** so that, upon movement of the ramp **40** to a position such that the legs may clear the upstanding lips or projections **171***a*, the legs will then move to the position shown in FIG. **11** with respect to the ramp **40**. The ramp **40** may then be lowered to a position such as that shown in FIG. **11**, or any intermediate position which would otherwise be prevented by the normal working position of the legs **170** with respect to the ramp **40**, as shown in FIG. **10**.

Referring now to FIGS. **13** and **14**, a first alternate embodiment of a dock leveler in accordance with the invention is illustrated and generally designated by the numeral **220**. The dock leveler **220** includes a ramp **240** which is hinged to dock **33** at hinge means **39** for pivotal movement between working and stored positions. A lip **248** is hinged to the forward edge of the ramp **240** at hinge means including a hinge pin **50**, such hinge means being substantially the same as the hinge between the lip **48** and the ramp **40** of the dock leveler **20**. The dock leveler **220** is operable to be moved from a stored position to an elevated position, as shown in FIG. **13**, preparatory to movement downward into a position in engagement with a load deck of a vehicle, not shown.

The ramp **240** is moved from a stored position to an elevated position shown in FIG. **13** by an actuator **256** similar to the actuator **56** and including a drive motor **64**, a gear reduction drive **66** and a support tube **63** for the power screw, not shown in FIG. **13**. An extensible tube member **262** is shown for the actuator **256** which is similar to the tube member **62** and is operable to be telescoped in and out of the tube **63** in response to rotation of the aforementioned screw. The distal end **262***a* of tube member **262** is pivotally connected to a pivot link **270** which, in turn, is pivotally connected to the deck **240** at a clevis type pivot connection **277**.

When the actuator **256** is operated to extend the tube member **262** the link **270** pivots to the position shown wherein it engages an abutment **271** on the underside of deck **240**. Further extension of the tube member **262** from the tube **63** will elevate the ramp **240** upwardly about the hinge means **39**. Movement of the ramp **240** upwardly may be assisted by a counterbalance spring **282** secured to a wall **33***a* of dock **33** at one end of the spring and to a connection between two pivot links **283** and **284** which are, respectively, pivotally connected to the ramp **240** and to the dock wall **33***a*, as shown. The links **283** and **284** are also pivotally connected to each other at pivot means **285**, as shown.

Referring to FIG. **14** the leveler **220** is shown in a working position with the lip **248** engaged with a loadbed **49**. The position of the ramp **240** shown in FIG. **14** also coincides with a typical storage position for the leveler **220**. In the working position shown in FIG. **14** the actuator extension tube member **262** has been retracted substantially within the tube **263** and the link **270** has moved away from the abutment **271** so that, in the event that the ramp **240**, moves about its hinge **39** in response to changes in the elevation of the loadbed **49**, the ramp may move without imposing undue forces on the actuator **256**. Thanks to the configuration of the actuator **256** and its mounting on the pivot **88** the ramp **240** may move up and down while the link **270** and the actuator **256** merely move with respect to each other in scissors-like fashion about the pivot at distal end **262***a* without any undue force being imposed on the actuator mechanism **262**. Accordingly, a so called lost motion coupling is provided between the actuator **256** and the ramp **240** which allows the ramp to move with respect to the actuator without imposing any damaging forces on the actuator or causing the mechanism of the actuator itself to be driven by the forces imposed thereon.

The lip **248** is provided with suitable extension linkage, such as the links **316** and **320**, FIG. **13**, which are pivotally connected to each other at **322**. The link **320** is pivotally connected to the ramp **240** at **324** and the link **316** is pivotally connected to the lip **248** at pivot means **326**. A tension coil spring **328** is connected to the link **320** and to the dock bottom wall **33***b* for the dock pit in which the leveler **220** is disposed. Accordingly, the dock leveler **220** also enjoys the benefits of the actuator **256** which, upon positioning the ramp **240** and the lip **248** for transporting loads across the dock leveler between the dock **33** and a loadbed **49**, allows movement of the ramp **240** without imposing damaging forces on the actuator.

Referring now to FIG. **15**, a second alternate embodiment of a dock leveler apparatus in accordance with the invention is illustrated and generally designated by the numeral **330**.

The dock leveler apparatus **330** includes a ramp **332** similar in most respects to the ramp **40** and supported on a frame **334**, similar in many respects to the ramp **22**, for pivotal movement about a hinge **39**. The ramp **332** is connected to one end of a linear actuator **336** at a pivot connection **338**. Actuator **336** includes a suitable clevis member **340** having a generally cylindrical transverse flange **342** supporting an elongated guide tube **344**. An actuator abutment member **346** is disposed within the tube **344** and is contiguous with the flange **342**, as illustrated. Guide tube **344** includes a transverse guide flange **348** formed at its end opposite the abutment member **346** and operable to journal an elongated actuator extension tube **350**. Extension tube **350** is operably connected to a recirculating ball nut **352** which is threadedly engaged with an elongated actuator screw **354**. Actuator screw **354** is adapted to be rotatably driven by a reversible electric motor **64** through a suitable right angle gear drive mechanism **66**.

Actuator **336** also includes an outer guide tube **356** having a transverse bottom flange **358** and a cylindrical support member **360** extending from a housing **67** for the gear reduction drive mechanism **66** and supported thereby. An elongated coil compression counterbalance spring **361** is sleeved over guide tube **344** and extends between flanges **358** and **342** and within guide tube **356**. The lower end of the actuator **336** is supported on the frame **334** at a pivot connection **88** in a manner similar to which the actuator **56** is supported on frame **22**. The portion of the actuator **336** including the motor **64**, the gear drive mechanism **66**, the screw **354**, the ball nut **352** and the extension tube **350** may also comprise a linear ball drive actuator of the 85199 series available from Motion Systems Corporation.

The actuator **336** is advantageously arranged in that the counterbalance spring **361** is journaled within the guide tube **356** and the extension tube **350** is provided with a suitable tang **351** at its distal end which fits in a cooperating slot in the abutment member **346** to prevent rotation of the extension tube **350** as the screw **354** is rotated.

Referring now to FIG. **15**A, another embodiment of an actuator for the dock leveler of the present invention is illustrated and generally designated by the numeral **336***a*. The actuator **336***a* includes the reversible electric motor **64**, right angle gear drive mechanism **66** and actuator extension tube **350**, also operably connected to a recirculating ball nut **352** which is operably connected to an actuator screw **354**, both shown disposed within extension tube **350** in FIG. **15**A. Extension tube **350** is disposed within a guide tube **344***a* which is engaged with an abutment member **346***a* having a generally circular flange **342***a* formed thereon. A shaft member **340***a* is suitably connected to the flange **342***a* and is operable to be connected to the ramp **332** at pivot connection **338**, in place of the actuator **336**.

The actuator **336***a* also includes an outer guide tube **356***a* having a transverse flange **358***a* formed thereon and operable to retain one end of coil compression spring **361**, the opposite end of the spring being engaged with flange **342***a*. A flanged spool member **363***a* is disposed within guide tube **356***a* at the end of the tube which is adjacent the abutment member **346***a* in the retracted or collapsed position of actuator **336***a*, shown in FIG. **15**A. The spool member **363***a* is suitably permanently connected to the guide tube **356***a*, such as by welding. The end of tube **344***a* opposite the abutment **346***a* is also provided with a flange **365***a*, the diameter of which allows the flange to slide within the tube **356***a* until it engages the spool **363***a*. The spool **363***a* suitably journals the tube **344***a* with respect to the tube **356***a* and delimits axial extension of the guide tube **344***a* with respect to the tube **356***a* when the flange **365***a* engages the spool. In this way, if the aforementioned nut becomes disengaged from the screw on assembly or disassembly of the actuator **336***a*, the abutment **346***a* and guide tube **344***a* will not become disengaged from the actuator. A suitable yoke-type mounting bracket **360***a* is connected to the flange **358***a* and supports the motor **64** by a pin **88**. The end of the yoke member **360***a* opposite the end which is attached to the flange **358***a* is adapted to be suitably supported on the dock leveler frame by a pivot pin, not shown in FIG. **15**A. Upon assembly of the actuator **336***a*, the flange **365***a* may be suitably welded to the tube **344***a* and the spool **363***a* may be suitably welded to the tube **356***a* to prevent the aforementioned unintended disassembly of the actuator. In the embodiment of the actuator shown in FIG. **15**A, the tubes **344***a*, **356***a*, the spool **363***a* and the flange **365***a* are preferably formed of a suitable metal which is easily weldable upon assembly of the actuator as described above.

Referring further to FIG. **15**, and also FIG. **16**, the dock leveler apparatus **330** includes additional counterbalance spring mechanism **362** for counterbalancing at least part of the weight of the ramp **332**. The counterbalance spring mechanism **362** includes two parallel coil tension springs **364** which are connected at one end to a depending lever arm **366** connected to the ramp **332**. The lever arm **366** includes opposed projections **366***a*, FIG. **16**, and **366***b* for supporting adjacent ends of springs **364**. The opposite ends of the springs **364** are connected to a bracket comprising a threaded nut **370** and opposed arm portions **370***a* and **370***b* which are connected directly to the ends of the springs **364** as shown.

The nut **370** is threadedly engaged with an elongated spring tension adjustment screw **372** which is supported in a bearing block **374** supported between two trunnion support members **376** and which are adapted to journal opposed trunnions **378** of the bearing block **374**. The screw **372** includes a generally cylindrical bearing portion **379** journaled for rotation in the bearing block **374** and having a hex nut **380** disposed on a threaded end portion **372***a* of screw **372**. The nut **380** is also engageable with the bearing block **374** for retaining the screw **372** in the bearing block against linear displacement toward the springs **364**. Nut **380** is operable to engage a shoulder, not shown, between screw portions **372***a* and **379**. The nut **380** may be engaged by a suitable wrench for rotating the screw **372** to effect axial translation of the nut **370** to adjust the tension in the springs **364**, thereby effectively changing the counterbalance effort of the springs as regards the tendency for the ramp **332** to pivot in a clockwise direction, viewing FIG. **15**, about the hinge **39**.

The counterbalance spring mechanism **362** is advantageously disposed adjacent one side of the frame **334**. The trunnion support members **376** are suitably mounted on a support member **26***c* which projects laterally from a frame beam member **26**. Moreover, since the counterbalance spring mechanism **362** is arranged such that the nut **380** is disposed adjacent both a lateral side of the frame near a forward edge defined by the frame member **24** good access to the screw **372** for adjusting the tension in the counterbalance springs is provided. The overall arrangement of the actuator mechanism **336** together with the counterbalance springs **361** and **364** for the apparatus **330** is advantageous in that the power requirements for the actuator are substantially reduced while the dock leveler **330** enjoys substantially all of the benefits of the dock leveler apparatus **20**, for example.

Referring now to FIG. **17**, the dock leveler apparatus **20**, **220** or **330** may be adapted to include an alternate embodiment of a ramp support leg retraction mechanism illustrated in FIGS. **17** through **22**. By way of example, the apparatus **330** is adapted to include a support leg retraction mechanism, generally designated by the numeral **390**. Only pertinent portions of the ramp **332** and the frame **334** are shown in FIGS. **17** through **20** in the interest of clarity and conciseness. Ramp **332** includes spaced apart depending support legs **392**, one shown in FIGS. **17** through **21**, similar to and supported in the same manner as the support legs **170** for the apparatus **20**. Each support leg **392** is mounted on ramp **332** for pivotal movement about a pivot pin **394** between the position shown in FIGS. **17** and **18** and the positions shown in FIGS. **19** and **20**. Each support leg **392** is prevented from moving to a retracted position by a bracket **396** similar to the bracket **171**, **171***a*.

The support legs **392** are urged to the position shown in FIGS. **17** and **18** by a retraction mechanism pivot link or member **398** comprising a somewhat triangular shaped plate which is mounted for movement about a pivot pin **400** supported by spaced apart depending brackets **402** connected to the ramp **332**, see FIG. **21** also. In the position shown in FIG. **17** the pivot member **398** is urged to move in a counterclockwise direction, viewing FIG. **17**, by a tension coil spring **404** suitably connected at one end to the member **398** at a connection pin **398***a* and at its opposite end to a support bracket **406** mounted on ramp **332**. The pivot member **398** is also connected to lost motion linkage means **408** extending between and connected to the pivot member and a support leg **392** at spaced apart connection points **398***b* and **392***b*, respectively.

Referring briefly to FIGS. **21** and **22**, the lost motion linkage **408** comprises a first elongated rod **410** which has a transverse end portion **412** connected to leg **392** at connection point **392***b*. The opposite end of rod **410** is connected to a channel shaped bracket **414** having spaced apart flanges **416**, each provided with a suitable bore therein for slidably journaling a second elongated linkage rod **418**. A transverse distal end **420** of rod **418** is suitably connected to the pivot member **398** at connection point **398***b*, as shown in FIGS. **21** and **22**. Rod **418** also includes a cylindrical collar or stop member **422** supported thereon and normally fixed against movement relative to the rod **418** but being suitably adapted to be positioned at selected locations along the rod **418**. Stop member **422** may include a suitable set screw **423**, FIG. **21**, for securing the stop member to rod **418**. Stop member **422** is movable with rod **418** between the flanges **416** from the position shown in FIG. **21** to the position shown in FIG. **22**, for example. Accordingly, rod **418** may move relative to rod **410** over the distance between the flanges **416** to form a lost motion connection between the pivot member **398** and the leg **392**. For example, when the leg retraction mechanism **390** is in the position shown in FIG. **17** the linkage **408** is in the position shown in FIG. **21** and when the pivot member **398** has moved to the position shown in FIG. **18** the linkage **408** has assumed the position shown in FIG. **22**.

Referring further to FIGS. **17** and **18**, in particular, the pivot member **398** also includes a projection **399** formed thereon which, in a certain position of the pivot member, is engageable with a post member **401** extending upward from the frame **334** and supported on one of the frame members **26**, for example. The pivot member **398** is also operably connected to a manual pull ring **194** by way of a rod **192***a* and a link **192***b* journalled on the pin **400**. The pull ring **194** is normally disposed in a recess **333** in the ramp **332**, as illustrated. In the position of the pivot member **398** shown in FIG. **17**, the spring **404** urges the pivot member to pivot about the pivot pin **400** in a counterclockwise direction to cause the linkage **408** to urge the leg **392** into its upright position for supporting the ramp **332**, as shown. However, when the rod **192***a* is pulled link **192***b* engages pin **398***a* and moves the pivot member **398** from the position shown in FIG. **17** to the position shown in FIG. **18** whereby the direction of forces exerted by spring **404** on pivot member **398** is reversed so that the pivot member **398** is now urged to move in a clockwise direction, viewing either FIGS. **17** or **18**.

Pivot member **398** moves to a limit position of the lost motion linkage **408** corresponding to the position of the linkage illustrated in FIG. **22** and exerts a biasing force on leg **392** urging the leg to pivot to a retracted position, that is, in a clockwise direction about its pivot pin **394**. The projections **396** and the weight of the ramp **332** exerting a downward force on the legs **392** prevent the legs from pivoting out of a ramp supporting position. However, when the ramp **332** is raised to the position shown in FIG. **19**, the legs **392** are pivoted to a retracted position, as shown as the pivot member **398** is moved further in a clockwise direction about its pivot **400**. In this way when the ramp **332** is lowered to the position of FIG. **20**, for example, the ramp may be moved to a below dock condition as described previously for the embodiment shown in FIG. **10**.

Referring further to FIG. **20**, when the ramp **332** moves to the so-called below dock position shown, the projection **399** engages the distal end of post **401** to cause the pivot member **398** to move back to a position wherein the spring **404** now, again, urges the pivot member **398** to move in a counterclockwise direction, viewing FIG. **20**, about its pivot pin **400**. Linkage **408** moves back to the position shown in FIG. **21** and the spring **404** exerts a force through pivot member **398** and linkage **408** on leg **392** urging the leg to assume its upright support position. Accordingly, when the ramp **332** is moved upward to a position slightly above the position shown in FIG. **17**, the legs **392** are pivoted back to the ramp support position whereby the ramp may then be lowered back to the position shown in FIG. **17** with the cross traffic legs in their working support position of the ramp. One advantageous aspect of the leg retraction mechanism **390** is that only one spring is required for moving the cross traffic support leg or legs **392** between their working position and a retracted position.

Referring now to FIGS. **23** and **24**, another embodiment of a support leg retraction mechanism as illustrated and generally designated by the numeral **514**. The support leg retraction mechanism **514** includes a first pivot member **516** connected to the ramp **332** at a pivot pin connection **518** for movement in clockwise and anticlockwise directions, viewing FIGS. **23** and **24**, respectively. The pivot member **516** is provided with a pin **520** supported thereon and projecting laterally therefrom between the pivot pin **518** and a distal end **516***a*. A coil tension spring **522** is connected at one end to the member **516**, preferably at the pin **520**, and the opposite end of the spring **522** is connected to the ramp **332** at a connection point **522***a*. A lateral projection **524** is supported on the member **516** spaced from the pivot pin **518** but between the pin **518** and the pin **520**.

The leg retraction mechanism **514** also includes an elongated link **526** pivotally connected by a pivot pin **528** to one of the legs **392** at one end of the link. Link **526** also includes, adjacent its opposite end, an elongated slot **530** which receives the pin **520** to form a lost motion connection between the member or link **516** and link **526**.

Viewing FIGS. **23** and **24**, it will be noted that, in the position of the links **516** and **526** shown in FIG. **23**, the spring **522** urges the link **516** to move in a counterclockwise direction, viewing the drawing figure, about pivot pin **518** and thus forces the pin **520** into engagement with the link **526** at one end of the slot **530** urging the link **526** to move the ramp support leg **392** into the position shown in supportive relationship to the ramp **332**. However, in response to moving the link **516** from the position shown in FIG. **23** to the position shown in FIG. **24** the pin **520** is moved to the opposite end of slot **530** and, upon raising the ramp to a position where the legs **392** clear the brackets **396**, the spring **522**, which has moved "over center" with respect to the pivot pin **518**, now urges the link **516** to move in a clockwise direction about the pivot pin **518** to retract the leg to the position shown in FIG. **24**. The ramp **332** may then be moved to a below dock level position similar to the position shown in FIG. **20**.

When the ramp **332** is moved to the below dock level position, such as shown for the previous embodiment of retraction mechanism in FIG. **20**, the projection **524** is operable to engage the distal end of post **401** to move the link **516** back to a position wherein the spring **522** again urges the link **516** to move in a counterclockwise direction thus urging the link **526** and the legs **392** to move back to the ramp supporting position of the legs. Thus, the leg retraction mechanism **514** operates in a manner similar to the leg retraction mechanism **390** and requires only one spring for urging the ramp support legs to be in a working position and a retracted position, depending on the position of link **516**.

Those skilled in the art will appreciate, viewing FIGS. **23** and **24**, that the positions of the links **516**, **526**, the projection **524**, the spring **522** and the post **401** may be arranged such that the movement of these members between their working positions may be accomplished by predetermined proportions of these elements and their positions on the ramp **332** and the frame **334**.

It is believed that the embodiments of the dock leveler described hereinabove may be constructed and operated by one skilled in the art based on the description herein. The dock levelers **20**, **220** and **330** and the mechanisms described herein may be constructed using conventional engineering materials for such apparatus and the operation of each embodiment, including the embodiments of the linear actuators and the leg retraction mechanisms, is believed to be understandable to those of ordinary skill in the art based on the foregoing description.

Although preferred embodiments of the invention have been described in detail herein, those skilled in the art will also appreciate that the invention may be practiced with various substitutions and modifications without departing from the scope and spirit of the appended claims.

What is claimed is:

1. A dock leveler for forming a path between a loading dock and a loadbed of a vehicle for transferring cargo therebetween, including:

a frame;

a generally planar ramp including hinge means for pivotally moving said ramp from a generally horizontal storage position to an elevated position about said hinge means; and

an actuator operably connected to said ramp and including a drive motor drivingly connected to a linearly extensible member for causing said ramp to move to an elevated position, a first guide tube operably connected to said linearly extensible member and said ramp and operable to permit movement of said ramp in opposite directions without imposing actuator driving forces on said drive motor, said actuator includes a rotatable screw operably connected to said drive motor and engaged with a nut connected to said linearly extensible member disposed between said screw and said ramp, said linearly extensible member being disposed in said first guide tube in telescoping sleeved relationship for moving said ramp to an elevated position in response to rotation of said screw, and a second guide tube connected to said actuator and disposed in sleeved relationship around said screw and said first guide tube.

2. The dock leveler set forth in claim **1** including:

a counterbalance spring disposed in sleeved relationship around one of said guide tubes for urging said ramp to move to an elevated position, and means for retaining said guide tubes engaged with each other.

3. A dock leveler for forming a path between a loading dock and a loadbed of a vehicle, comprising:

a generally planar ramp member disposed for movement between a storage position and a position for engagement with a vehicle loadbed;

an actuator connected to said ramp member and including a reversible electric drive motor drivingly connected to one of an elongated rotatable screw member and a nut member, a linearly extensible member connected to the other of said screw member and said nut member and responsive to operation of said motor to move in one direction to move said ramp to an elevated position, said linearly extensible member being responsive to rotation of said one of said screw member and said nut member to move in an opposite direction to a retracted position, and an elongated tubular member operably engaged with said linearly extensible member in telescoping relationship and operable to allow floating motion of said ramp in opposite directions in response to movement of said loadbed when said linearly extensible member is in said retracted position without imposing driving forces on said motor through said nut member and said screw member; and

a control circuit for energizing said motor to move said linearly extensible member in opposite directions.

4. The dock leveler set forth in claim **3** wherein:

said actuator includes a counterbalance spring disposed in sleeved relationship over said tubular member for biasing said ramp toward an elevated position.

5. The dock leveler set forth in claim **4** wherein:

said linearly extensible member is operably engaged with said tubular member by a cooperable pin member to prevent rotation of said linearly extensible member and said nut relative to said tubular member.

6. A dock leveler comprising:

a ramp supported for movement between a storage position and an elevated position;

an actuator connected to said ramp and including a motor operably connected to a linearly extensible and retractable member for moving said ramp to said elevated position; and

a control circuit for operating said motor to extend said linearly extensible member to move said ramp to said elevated position and for operating said motor to retract said linearly extensible member, said control circuit including a timer operable to effect de-energizing said motor on retraction of said linearly extensible member, a switch including an actuating member for said switch, said switch being movable to a first position by said actuating member to operate said motor to extend said linearly extensible member to move said ramp toward said elevated position, and, upon release of said actuating member, move to a second position to cause said motor to operate to retract said linearly extensible member, the movement of said switch to said second position being effective to cause said timer to de-energize said motor after a predetermined time period commencing with movement of said switch to said second position.

7. A dock leveler for forming a path between a loading dock and a loadbed of a vehicle for transferring cargo therebetween, including:

a frame;

a generally planar ramp including hinge means for pivotally moving said ramp from a generally horizontal storage position to an elevated position about said hinge means; and

an actuator operably connected to said ramp and including a reversible rotary drive motor drivingly connected to a linearly extensible member by way of cooperable screw and nut members and operable to extend said linearly extensible member to move said ramp to an elevated position, said drive motor being reversible to retract said linearly extensible member, and an elongated link pivotally connected at one end to said linearly extensible member and operable upon retraction of said linearly extensile member to permit floating movement of said ramp in opposite directions about said hinge means without imposing actuator driving forces on said drive motor.

8. The dock leveler set forth in claim **7** wherein:

said link is pivotally connected to said ramp at another end of said link.

9. A dock leveler for forming a path between a loading dock and a load bed of a vehicle for transferring cargo therebetween, said dock leveler including:

a frame;

a generally planar ramp including hinge means for pivotally moving said ramp from a generally horizontal storage position to an elevated position about said hinge means; and

an actuator operably connected to said ramp and including a drive motor drivably connected to an elongated screw member, a nut engaged with said screw member and with an elongated linearly extensible member operable to effect moving said ramp from said storage position to said elevated position in response of rotation of said screw member by said motor, control means for operating said motor to rotate said screw member in one direction to extend said linearly extensible member to move said ramp to an elevated position and to rotate said screw member in an opposite direction to move said linearly extensible member to a retracted position, and an elongated guide member operably connected to said actuator in telescoping relationship with said linearly extensible member to allow floating motion of said ramp in opposite directions about said hinge means when said linearly extensible member is in said retracted position.

10. The dock leveler set forth in claim **9** wherein:

said guide member comprises an elongated tubular member disposed in telescoping sleeved relationship over said linearly extensible member.

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